THE GEOGRAPHICAL REVIEW

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Two Route Surveys Across Ungava Peninsula: (1) via the Povungnituk and Payne Rivers; (2) via Lake Minto and Leaf River, by Robert J. Flaherty. 8 miles to 1 inch (1:506,880), with inset, 1:3,150,000, of Ungava Peninsula incorporating the latest sources. 1918. Peninsula between Hudson and Ungava Bay in northern Labrador.

Map of Eastern Labrador, by Mrs. Leonidas Hubbard, Jr. 1:1,584,000 (25 miles to 1 inch). 1906. Embodies original survey of the George and Nascaupee Rivers across eastern Labrador from Ungava Bay to the Atlantic.

Map of the Catskill Mountains. 1:190,080 (3 miles to 1 inch). 1907. Generalized from the topographic sheets of the U. S. Geological Survey.

Mercator's Map of the World, 1538. Facsimile in black-and-white, reproduced from the original in the Society's collection (only two original copies of this map are known). 1885.

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OUR CONTRIBUTORS

Mr. Heller is a naturalist of note. He has taken part in or conducted numerous zoölogical expeditions, notably to the Galápagos Islands (Stanford University expedition, 1898–99; see the September *Review*, p. 232); Alaska (U. S. Biological Survey, 1900); Mexico and Central America (Field Columbian Museum, 1901–05); East Africa (Smithsonian Institution, under Colonel Roosevelt, 1909–10; Rainey expedition 1911–12); Peru (Yale University and National Geographic Society, 1915); southwestern China and Tibet (American Museum of Natural History, 1916–17; see the May, 1916, *Review*, p. 381). Mr. Heller is the joint author with Colonel Roosevelt of "Life Histories of African Game Animals."

Mr. Cotton is one of the leading physiographers of the modern Australian school. He is lecturer on geology at Victoria University College, Wellington, New Zealand. Some of his recent papers are: The Physiography of the Middle Clarence Valley, New Zealand (*Geogr. Journ.*, Vol. 42, 1913); Fault Coasts in New Zealand (*Geogr. Rev.*, Vol. 1, 1916); The Structure and Later Geological History of New Zealand (*Geol. Mag.*, Vol. 3, 1916); Block Mountains in New Zealand (*Amer. Journ. of Sci.*, Vol. 44, 1917, reviewed in the current number of the *Review*, p. 380).

Mr. Wallis is an authority on the teaching of geography, on which subject he published an important book in 1915. His attention was more especially directed to Austria-Hungary while assisting in the compilation of the Royal Geographical Society's emergency war map of Europe, on which occasion the sheets covering this country were allotted to him. In this connection he discussed a new method of mapping density of population and distribution of nationalities (*Geogr. Journ.*, March, 1916). Two articles on the Danube Monarchy by Mr. Wallis, other than those forming part of the present series, have appeared in the *Review*: one on Hungary in December, 1917, and one on Austria in July, 1918. Others of his papers deal with the rainfall of the United States and (in the January, 1917, *Review*) the industrial geography of central England.

Mr. Stefánsson's Arctic explorations were made mainly on three expeditions: the first in 1906–07, to the Mackenzie delta; the second in 1908–12, on which the "blond" Eskimos, possibly descendants of the early Norse settlers of Greenland, were discovered in Dolphin and Union Straits; the third in 1913–18, with the later activities of which the present article deals. Besides a book, "My Life with the Eskimos," he has written, among other papers: Misconceptions about Life in the Arctic" (*Bull. Amer. Geogr. Soc.*, Vol. 45, 1915); "Prehistoric and Present Commerce Among the Arctic Coast Eskimo" (*Geol. Surv. of Canada Mus. Bull. No. 6*, 1914).

ARTICLES ON THE GEOGRAPHY OF THE WAR

published in the Geographical Review

The Great Russian Retreat. By D. W. JOHNSON. (25 pp.; with 6 maps and 6 photographs.) . . . . February, 1916.

The Balkan Campaign. By D. W. JOHNSON. (21 pp.; with 1 map and 4 photographs.) . . . . . July, 1916.

The Conquest of Rumania. By D. W. JOHNSON. (19 pp.; with 1 map and 3 photographs.) . . . . . June, 1917.

In these three articles Professor Johnson discusses the influence of geographical conditions on the military campaigns in the areas affected. The second deals with the campaign against Serbia at the end of 1915. Each article gives an outline of the physical features of the area discussed and is illustrated by maps showing the positions of the battle lines at various critical junctures.

The Military Campaigns Against Germany's African Colonies. By G. M. WRIGLEY. (22 pp.; with 5 maps.)

The more pronounced control of geographic conditions in the African as compared with the European campaigns, because of the larger areas affected and the greater dependency here of man on nature, is clearly brought out in this article. The campaign in each colony is illustrated by a map indicating the troop movements in relation to the topography. The article is accompanied by a full bibliography.

Europe at Turkey's Door. By LEON DOMINIAN. (9 pp.; with 2 maps.) . . . . . April, 1916.

Discusses the claims of the European powers to Turkish territory, based on political and economic grounds. Illustrated by a separate map showing the spheres of influence and territorial claims in Asiatic Turkey of Russia, England, France, Greece, and Italy.

The Geographical Distribution of the Balkan Peoples. By JOVAN CVIJIĆ. (17 pp.; with 1 insert map in color.) . . . . . May, 1918.

An article by the foremost geographer of Serbia. The accompanying colored map shows the distribution of nationalities and creeds in great detail.

The Zones of Civilization of the Balkan Peninsula. By JOVAN CVIJIĆ. (13 pp.; with 1 insert map in color.) . . June, 1918.

Discusses the growth and present distribution (shown on colored map) of the two main forces, Old Balkan (modified Byzantine) civilization and the patriarchal régime, and the subsidiary influences, Turco-Oriental, Italo-Mediterranean, Mediterranean, Central European, Western European.

The Balkans, Macedonia, and the War. By H. CHARLES WOODS. (18 pp.; 1 map and 10 photographs.) . . July 1918.

Albania and the Albanians. By H. CHARLES WOODS. (17 pp.; with 1 map and 8 photographs.) . . . . April, 1918.

Discussions of the politico-geographical problems by a first-hand observer of the country and its people.

Russia's War-Time Outlets to the Sea. (5 pp.; with 1 map.) . . . . . February, 1916.

Deals with the closing of the Baltic and Black Sea outlets to Russia by the war and her circumvention of this obstacle, especially by the construction of a railroad to Kola, an ice-free port on the Arctic Ocean. With map.

The Economic Resources of the Russian Empire. By E. K. REYNOLDS. (17 pp.; with 1 map and 10 photographs.) . . . . . April, 1916.

Accompanied by a map showing the distribution of the main economic resources of both European and Asiatic Russia.

The Finn in America. By EUGENE VAN CLEEF. (30 pp.; with 5 maps, 13 photos.) . . . . . September, 1918.

In this study of the effects of transference to an environment physically similar yet politically unlike their old home light is shed on the perplexing problems facing this deserving people in Europe as a result of the war.

(Continued on next page)

The Racial History of the British People. By H. J. FLEURE. (16 pp.; with 2 maps.) . . . . . March, 1918.

A geographical exposition of the early racial movements which led to the settlement of Britain and their reflection in the composition of the present-day population.

Flanders. By RAOUL BLANCHARD. (17 pp.; with 2 maps and 9 photographs.) . . . . . December, 1917.

A summary of the geography, physical and human, of one of the most important battle areas of the present war.

Alsace-Lorraine and Europe. By LUCIEN GALLOIS. (27 pp.; with 1 insert map in color and 5 photographs) . August, 1918.

An exposition of the geographical basis of Alsace-Lorraine's attachment to France. Accompanied by a colored map showing relation of mineral resources to territorial changes.

The Peoples of Hungary: Their Work on the Land. By B. C. WALLIS. (17 pp.; with 8 maps.) . . December, 1917.

The Peoples of Austria. By B. C. WALLIS. (14 pp.; with 5 insert maps in color.) . . . . . July, 1918.

Discussions of the human geography of the two states, with special attention to the problem of nationalities. Two of the accompanying maps in each article, representing by a new method the population density and distribution of nationalities, are especially valuable.

(1) The Rumanians in Hungary; (2) The Slavs of Northern Hungary; (3) The Slavs of Southern Hungary; (4) Central Hungary: Magyars and Germans. By B. C. WALLIS. (16, 14, 13, and —— pp., each with 1 text-map, 3 insert maps in color, and 1 diagram.) . . . . August, September, October, November, 1918.

A series of four articles discussing in detail the human geography of the four parts into which Hungary may be divided by nationality groups. The articles are accompanied by colored maps which can be combined to form three maps of the whole of Hungary, showing relief, nationalities, and population density.

The Carpathians: Physiographic Features Controlling Human Geography. By EMMANUEL DE MARTONNE. (21 pp.; with 2 text-maps, 1 insert map in color, 3 diagrams, and 10 photographs.) . . . . . June, 1917.

A general account, illustrated by a colored physiographic map, of the interrelations of the physical features and human life, many of which have a bearing on the military operations of the present war in this area.

Poland: The Land and the State. By EUGENIUSZ ROMER. (20 pp.; with 12 maps.) . . . . . July, 1917.

A geographical interpretation of Poland's history and development and an exposition of her essential geographical unity. The article is accompanied by ten black-and-white maps illustrating the racial and territorial development of Poland from 800 to 1795.

Aëronautical Charts. By OMAR B. WHITAKER. (5 pp.; with 2 maps.) . . . . . July, 1917.

Aëronautical Maps and Aërial Transportation. By HENRY WOODHOUSE. (22 pp.; with 4 maps, 3 drawings, and 5 photographs.) . . . . . November, 1917.

European War Maps. By W. L. G. JOERG. (4 pp.) . . July, 1917.

The first two articles discuss a phase of mapping of high importance in the development of the aëroplane. They are illustrated by reproductions of aëronautical maps used in this country and in Europe. The second article also deals with the commercial possibilities of aëronautics in the immediate future. The third article gives a selected list of maps, detailed topographic sheets as well as general maps, of use in following the military operations in Europe.

THE
GEOGRAPHICAL REVIEW

VOL. VI OCTOBER, 1918 NO. 4

THE GEOGRAPHICAL BARRIERS TO THE DISTRIBUTION OF BIG GAME ANIMALS IN AFRICA

By EDMUND HELLER

Only those persons who have traveled through the highland grassy veld of East or South Africa realize how extremely abundant big game animals are in these regions. The favorite feeding grounds on the plains are as well stocked with big game as are our ranches of the West with cattle. On the plains of British East Africa I have often seen five hundred or more head of big game in a day's trek over such favored spots as the Loita, Athi, and Uasin Gishu Plains. From some of the small kopjes rising above the Loita Plains I have looked down and counted at one time some three hundred head of hoofed game feeding in small herds and groups made up of such species as kongoni hartebeests, Thomson and Grant gazelles, wildebeests, zebras, Masai giraffes, elands, topis, waterbucks, impallas, and wart hogs. Associated with these herds but hidden by the grass were such cover-haunting species as steinboks and plains duikers, which are of small size. Fully a third of this assemblage of game was made up of zebras, which occurred in herds of fifteen to twenty animals. The wildebeests were few in number and in herds, but the hartebeests and gazelles were very numerous and scattered about in groups of mixed species as far as the eye could see. Large assemblages of game of this sort could be seen daily on the same plain, for it is quite normal and not due to the temporary crowding of a favorite feeding ground. In the immediate vicinity of such herds but hidden during the day in cover lurk such carnivorous animals as hyenas, jackals, cheetahs, lions, and an occasional leopard.

RANGES OF BIG GAME ANIMALS

This circumstance, so fortunate for the naturalist, must be accredited to a benign policy of conservation. Before the European had been in the

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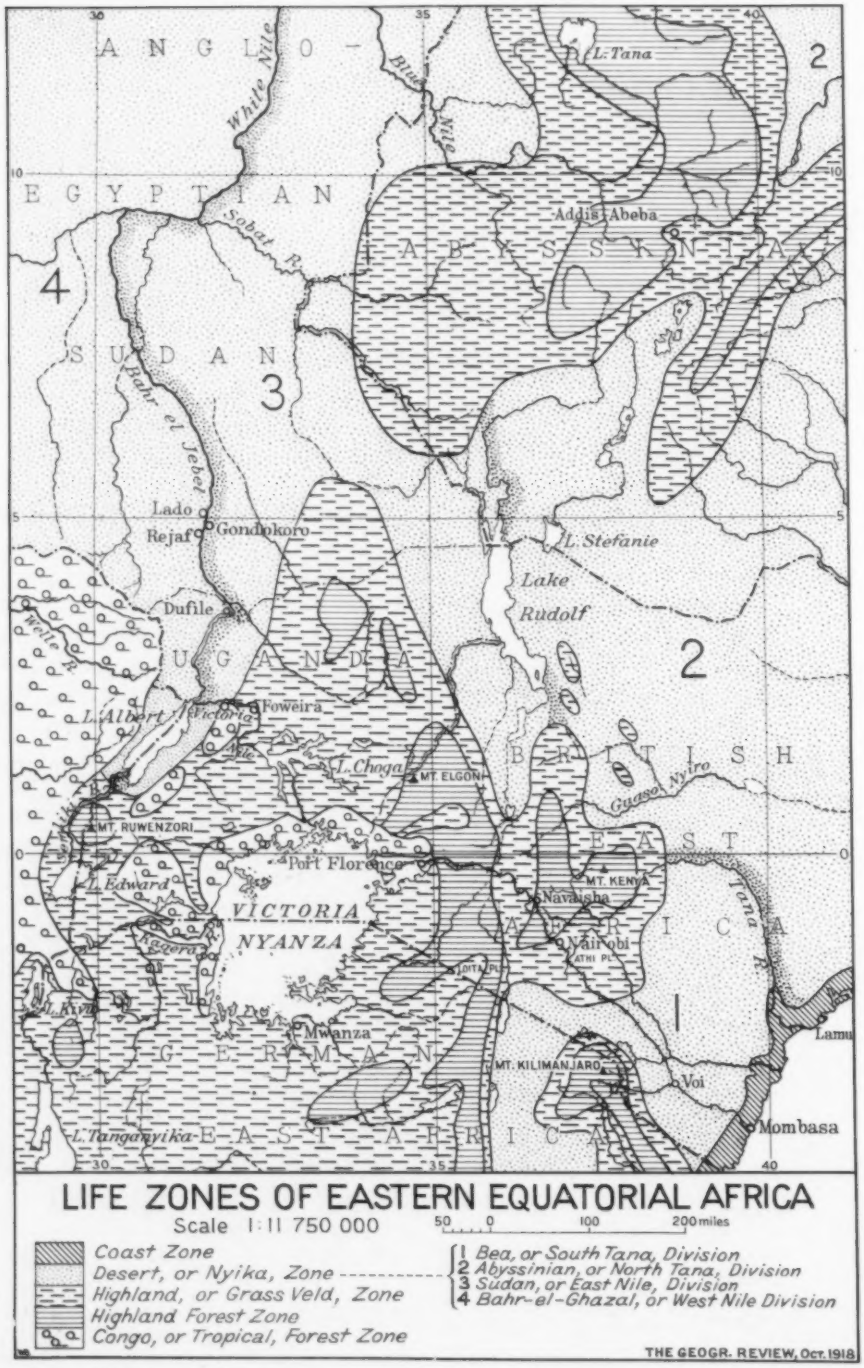

FIG. 1—Map showing the life zones of eastern Equatorial Africa and the subdivisions of the desert, or nyika, zone. Scale, 1:11,750,000.

territory long enough to effect any serious diminution of the game the government created vast reserves and a system of rigorous game laws.[1]

The native tribes are chiefly agricultural and seldom if ever eat the meat of game animals or slaughter them. Fire arms have carefully been kept from them by the European governments under whose protection they now dwell. Hence today, with the possible exception in certain districts of the elephant and black rhinoceros, we find the big game still enjoying their natural range. Another factor favoring our knowledge of the ranges of the big game mammals is the comparatively fixed character of the distribution of most species: because of the equable climate and the permanence of the grass and other vegetation there is little tendency to seasonal or other migrations. In habits most of the animals now under consideration live on open plains or at times on plains bearing a widely scattered growth of thorn trees or bush in which cover they are readily detected and can themselves detect their enemies by sight alone. The chief game animals such as gazelles, hartebeests, wildebeests, zebras, and some others, are open-plains animals and cannot be driven into thick cover even by an army of pursuers. These animals have developed great fleetness of foot and trust to speed alone to escape a dangerous enemy. The open plains are therefore their haven and their home, and they are easily detected wherever they occur, so that their distribution is now well known. Since the beginning of the present century great numbers of sportsmen have annually gone on *safari* in Equatorial Africa, and today the distribution of the bush and forest species, such as the buffaloes, bongos, bushbucks, giant pigs, duikers, elephants, etc., as far as their haunts are concerned, is quite as well known as that of the plains antelope. This unusually favorable combination of circumstances has enabled us to map out with a high degree of accuracy the actual distributional limits of big game mammals in Equatorial Africa.[2]

Factors Controlling Distribution

Notwithstanding the completeness of our knowledge of the facts of such distribution we are at a loss to explain them. In all species there is a natural tendency to enlarge the area of distribution, but it is held in check by forces of whose manner of control we know little except in a general way, or in the case of some few species only. We see the ranges of species brought to a halt at certain points by high mountain chains, sand deserts, great forests, large rivers, lakes, and seas. Climate, we know, is one of the chief barriers to areal spread, but of the manner of its operation other

[1] For notes on the preservation of big game in Africa and for maps of the game preserves in British East Africa and other British possessions in Africa see J. Stevenson-Hamilton's "Animal Life in Africa," London, 1912.—Edit. Note.

[2] For maps of the range of various big game mammals see Roosevelt and Heller's "Life Histories of African Game Animals," 2 vols., New York, 1914. Attention may also be called to the bibliography of eastern Equatorial Africa at the end of Volume 2.

FIG. 2—Scene in the great Rift Valley of East Africa. Mount Longonot, a lofty volcano with perfectly preserved crater, in the background.
(Illustrations, unless otherwise stated, from photographs by the author.)

than in limiting certain vegetable growths which may furnish food or cover to the species concerned we know little indeed. An important rôle in the limitation of mammal ranges in Equatorial Africa is played by unseen foes, by disease germs or blood-sucking insects which transmit them, such as various species of tsetse flies, ticks, mosquitoes, etc. The purpose of the present paper is to demonstrate the range limitations of big game mammals in Equatorial Africa through the operation of certain of these controls—the great geographical barriers such as the high mountain escarpments of the Rift Valley, the great rivers, the Nile and Tana, the deserts of British East Africa and Abyssinia, the forests, and the climatic barriers.

The Saharan Barrier

The African fauna of today has been preserved to us through the barrier of the vast Sahara Desert, which through a long period of time has prevented the more modern animals of Asia and Europe from reaching Africa proper. The real Africa, or the Ethiopian region of biologists, comprises only that part of Africa south of the Sahara Desert. North Africa, which borders the Mediterranean, has a Eurasian fauna. The chief big game mammals—sheep, ibex, and deer—are generically the same as those inhabiting Europe and Asia and only distantly related to the antelopes of Ethiopia. During middle Tertiary time, however, antelopes of several genera, hippopotamuses, lions, hyenas, and other true African mammals lived in Europe and Asia also, and this fact has led to the inference that Africa during that remote period obtained its present fauna from Eurasia. The evidence, however, is very one-sided, for Africa proper—Ethiopia—has practically no fossil record to balance against that of Eurasia; hence the theory of Eurasian derivation is accepted as plausible only. Africa is a very old continent and has without doubt been the birthplace of many groups of animals and plants.

Ethiopia and Its Two Faunal Regions

The Ethiopian realm of zoölogists has two main faunal regions, the rather dry plains and plateau country of East and South Africa, which is characterized by its great herds of game, and the great forested area of the Congo Basin, which has a humid climate and a heavy rainfall and where game animals are few in species and individually very rare.[3] The former region, South Africa and East Africa (the area as far west as Lake Tanganyika and the Nile and as far north as Abyssinia), shows a certain homogeneity in climate, vegetation, and fauna and is the big game region of Africa. The whole of the eastern half of Africa rises in a series of plains and plateaus from the coast westward towards the interior, where much

[3] Compare the note in the "Geographical Record" for this month on "African Fish Fauna and Faunal Regions."—Edit. Note.

of the land reaches elevations of 4,000 to 7,000 feet. This elevated interior tract, which extends from Abyssinia to the Cape region of South Africa, has an agreeable climate, free from tropical fevers, and it will some day support a large Caucasian population. The white settlers who have thus far established themselves here are leading comfortable, contented lives and are engaged in successful agriculture and experimental stock-raising. This, indeed, is not the Africa of popular imagination. By most people Africa is visualized as a land of low tropical jungle in which lurk

FIG. 3—The Rift Valley at Lake Elmenteita. Volcanic cone in the background. (Photo by C. E. Akeley.)

deadly fevers fatal to the white man. Such an incomplete and partial picture, doubtless established by Stanley's vivid account of his travels in the Congo Basin, is, however, being rapidly dissipated today by the numerous and annually increasing accounts of travel and adventure in eastern Africa.

The Life Zones of Eastern Equatorial Africa

Without doubt the most logical way of describing the distribution of big game mammals in eastern Equatorial Africa is by a discussion of the life zones we find there. By this, the ecological method, we shall associate the floral features, the climate, and the geological formations with the animal life and show some of the influences these features have on big game distribution. Human relationships will also be briefly noted.

The Coast Zone

Bordering the eastern coast on the shores of the Indian Ocean is a narrow strip of land of tropical appearance as regards its tree growth and climate (map, Fig. 1). The width of this strip is not more than fifteen miles on an average, and it terminates at Lamu, north of which the second, or desert zone, actually reaches the seashore. The climate of this coast strip is equable and somewhat moist, owing to the presence of the sea, so that the cocoa palm is here a dominating feature of the landscape.

Fig. 4—Looking down into the Rift Valley south of Lake Baringo. (Photo by C. E. Akeley.)

The cocoa palms are in a semi-cultivated state, but beyond the territory occupied by them the land is thickly bushcovered, with occasional groups of the forked dûm palms and the gouty baobab tree. There are definite rainy and dry seasons, but the country never has a really arid appearance. During the rainy season the bushes blossom and trees such as the baobab leaf out into life. The coast at Mombasa is a coral formation, the town itself being located on a coral island set in a deep indentation of the coast and guarded on its sea side by numerous coral reefs on which the breakers pound. Inland a short distance is a yellowish sandstone of Triassic age, and this formation continues into the arid desert area a short way. Immediately beyond the coral formation the land rises gently and slopes up to the desert plateau, which is in many places flanked by a low escarpment a hundred feet or so in height.

Mammals of the Coast Zone

The sable antelope, the trophy most prized by the sportsman, occurs only in this narrow maritime zone in Equatorial Africa, and here it reaches its extreme northern limit. Farther southward, from Lake Tanganyika to the Cape region, it is a fairly common species, but on the coast of British East Africa it is of rare local occurrence, and few indeed are the sportsmen who have bagged it in this district. We know of no explanation for the fact that in South Africa the sable antelope inhabits cool uplands, while in Equatorial Africa it is found only in the low, hot coast region. Buffaloes still occur in the bush of the coast, but they are now few in numbers and seem never to have regained their high place in faunal society since the rinderpest swept the great herds away thirty years ago. Formerly elephants wandered through the bush of the coast zone, but they have long since been shot for their ivory by traders, to whom the coast ports have been accessible for at least two centuries. Haunting the coast forests, formerly the home of the giant among living mammals just referred to, is a diminutive antelope no larger than a hare and known as the blue duiker. It is a distinct race peculiar to the coast zone, and no representative of the species is to be found inland until we reach the Nile watershed some four hundred miles distant. One of the hangers-on in the zone is Haggard's oribi, a small antelope which lives on the grassy flats bordering the zone on its inland or desert side. A host of other game mammals occur in the coast district, but none are peculiar to it. Bush pigs, bushbucks, hyenas, leopards, and occasional lions are to be met with here.

The Coast Peoples: Swahili and Duruma

That comparative accessibility of the coast which encouraged the extermination of its economically valuable big game shows itself also in foreign influences on the native population. Several tribes of Bantu stock inhabit the coast district, but the predominating and best known is the Arab-modified Swahili, who has been the source of transport for all caravans to the interior from the very earliest organization of exploration and trading *safaris*. His language, Ki-Swahili, has gone with him and is now a *lingua franca* for all Equatorial Africa from sea to sea. The Swahili occupy the coast ports, islands, and larger towns, but there are still living several primitive tribes over much of the area planted to the cocoa palm. One of these, the Duruma, who occupy territory near Mombasa, probably live today much as the Swahili did before the Arabs came among them, bringing Mohammedanism and such Mohammedan arts as the building of mud-walled and stone houses. The Duruma live in small villages in thatched huts built in the groves of cocoa palms. Both the Swahili and Duruma are agricultural tribes, but they vary their diet by fish when such food is procurable at the seashore.

The Desert, or Nyika, Zone

Flanking the coast strip and covering an immense area inland we encounter next the desert, or nyika, zone. The term *nyika*—the country of the Wanyika—is used in Swahili to signify jungle or thornbush country. It has a width of from two hundred to as much as one thousand miles in its greatest eastward extension, where it embraces not only the coast drainage but much of the Upper Nile watershed as well. In altitude it ranges from 100 to 3,000 feet above sea level. The climate over this vast area is hot and dry, and the rainfall is not more than a few inches annually and is limited to a short period, sometimes less than a month. The nyika is not a desert in the strict sense but a bush region with open spaces of sandy soil between the scattered vegetation, much like the American deserts in California and Arizona. The bush and tree growth is specialized to resist dryness and remains leafless and dormant throughout most of the year, only resurrecting itself to leaf and blossom after the short rainy season. A great many of the species of desert bushes are members of or closely allied to the genus Acacia, which is a dominant African type. Several euphorbias of cactuslike appearance and usually miscalled cacti by the sportsmen have established themselves widely over the nyika. The two most prominent trees are the branching dûm palms and the gigantic trunked baobab, the latter usually leafless and desolate in appearance. Forming the undergrowth in this bush world are the formidable spike-shaped sansevierias and aloes. The British East African portion of the nyika is covered by a bright red soil derived from the granitic (gneiss) rocks which are to be seen as outcrops or low hills in many parts of the desert plain. North of the Tana River this red soil is replaced by a yellow sandy variety that is again met with in the Nile region in the same zone.

Mammals of the Nyika Zone

The streams which cross the nyika are marked by wide dry sandy beds and low banks, the water seldom or only after heavy rains reaching the surface and forming a true river. The margins of these dry streams are usually well defined by a narrow fringe of dûm palms and acacia trees. Aside from springs the game animals which inhabit the region obtain their water from holes which they themselves dig in the sandy bed of the streams in those places where the water is not more than two or three feet below the surface. The Tana River, which cuts direct through the desert from the base of Mt. Kenya to the Indian Ocean, is a permanent supply for the numerous herds living along its banks. With the exception of the Nile it is the only perennial river which traverses the nyika zone. Some few, however, of the game animals have become highly specialized for existence in the desert and have quite given up the habit of drinking water

FIG. 5.

FIG. 6.

FIG. 5—Giant euphorbia tree, Loita Plains, British East Africa.

FIG. 6—The baobab, a characteristic tree of the nyika, or desert, zone, and leafless most of the year. (Photo by C. E. Akeley.)

even when it is available. Such species are the gerenuk—the flamingo among antelopes, being chiefly neck and legs—the lesser koodoo, the diminutive dikdik, the rock-haunting klipspringer, and several others which live outside the range of our territory. The species of antelope just mentioned, with the exception of the dikdik and klipspringer, are peculiar to the nyika. Others which hold this distinction are the oryx, Grévy zebra, and reticulated giraffe; and these are limited to the nyika track north of the Tana River, which forms also the southern barrier for the Somali wart hog and the Hunter antelope, and the large-snouted dikdik. This river makes a singularly sharp barrier for such a species as the Hunter antelope, which is found only in the immediate vicinity of the river and only on its northern bank. This species is a distinct one and is the sole living representative of its genus. The Somali wart hog is also structurally a distinct species from the common wart hog. On the basis of this zoölogical evidence we are justified in assuming that the Tana River has been a barrier to these game mammals throughout most of the later Tertiary age. South of the Tana River we find occurring as peculiar forms the fringe-eared oryx, Thomson gazelle, Coke hartebeest, white-bearded wildebeest, and Masai giraffe.

Crocodiles as Barriers to Distribution

All large streams in tropical Africa are infested by crocodiles, which patrol the water's edge vigilantly for such prey as game mammals, which they seize by the muzzle or leg when in the act of drinking. The victim is then pulled into the stream and under the water, where it is devoured. Through fear of these reptiles game animals approach the margin carefully and seldom or never enter or swim across large rivers. An American sportsman, Mr. Fleischmann, actually witnessed the drowning of a full-grown rhinoceros by crocodiles in the Tana River. It was not possible to see in the dark water how many crocodiles had hold of the rhinoceros, but the huge beast was gradually pulled under the surface by some strong force. But the rivers of Equatorial Africa have not been a barrier to the distribution of a majority of the game mammals, and such occur on both sides of rivers ranging over the whole valley. Some few, like the sitatunga, are actually water-loving species and swim fearlessly, at least in Victoria Nyanza. Other species, like the Nile leehwi and the bushbucks and to a less extent the waterbucks, frequent reedy swamps on the margins of lakes and rivers. His gigantic size and fearsome tusks preserve the hippopotamus from attack by crocodiles, and the elephant is immune in much the same way. Crocodiles, however, have instilled a wholesome dread of large bodies of water in the minds of many antelopes and other ungulates, which has acted as an important deterrent to their distribution across such barriers throughout a long period of time.

FIG. 7—The crocodile, the guardian of the Tana. The Tana River is the chief barrier to big game animals in eastern Equatorial Africa. (Photo by C. E. Akeley.)

Tribes of the Nyika Zone

The Tana River acts to some degree as a barrier to man as well as to big game animals: the raiding Somali does not penetrate south of it. Scattered through the nyika zone in a few favored places where there are permanent water holes may be found a few families of the Wanyika tribe, who till the soil during the short rainy season and harvest a small variety of crops on which they subsist. The higher hills which rise above the plain in certain places, as in the vicinity of the station of Voi on the Uganda railroad, accumulate more moisture on their summits than the surrounding desert, and they are inhabited by another tribe, the Wateita, who find them a fertile field for the raising of millet, maize, bananas, and vegetables. Formerly the indigenous tribes found the mountain tops a secure refuge from their powerful warlike neighbors, the Masai, who once raided over the nyika as far as the sea itself. Inhabiting the upper edge of the nyika, where the highland grassy veld begins to encroach on the desert, we find another tribe, the Wakamba, who, though agricultural, do considerable hunting of game with bows and poisoned arrows. These people are fond of the flesh of game animals and are expert hunters and beaters, the latter method being one of their modes of capture. These people have the custom, unknown among other East African tribes, of filing down the incisor teeth to sharp points. The practice is usually associated with cannibalism, and with such the Wakamba have been credited, but the accusation is denied by Hobley.[4]

The Nile Nyika

The desert nyika extends far westward past Lake Rudolf to the Nile and then northward, embracing the vast expanse of the Sahara itself and becoming gradually more desolate and arid as we proceed northward from its southern border at Albert Nyanza. In the Upper Nile Valley, in the Lado Enclave and northern Uganda, the nyika lies at a general level of 3,000 feet and consists of grass-covered plains dotted at wide intervals with small trees and bushes. The rainy season is short but sufficient to produce a heavy growth of tall grass, which in the dry season is systematically burned by the natives. Only a few of the hardier or more favorably situated trees can withstand this annual ordeal by fire. The Nile itself flows through the region like a great newly cut canal without bordering forests or any marked luxuriance of vegetation except papyrus to mark its course. The characteristic trees of the Nile nyika are various species of acacia and other leguminous trees, the peculiar *Kigelia*, the *Borassus*, or fan palm, and the dûm palm. The climate in the dry season is hot and dry and decidedly more trying to a European than that of equal elevations in British East Africa. During the short rainy season the moisture

[4] C. W. Hobley: Ethnology of A-Kamba and Other East African Tribes, Univ. Press, Cambridge, 1910; reference on p. 18.

produces a humid, depressing climate quite as uncomfortable as that of the Congo forest region. The soil over much of the region is of the usual bright red (ferric oxide) clay variety so widespread in Africa.

The Nile as a Barrier

The Nile is a more important barrier to big game mammals than the Tana River; in fact it is the most important river barrier in all Africa. No fewer than five of the largest game mammals of eastern Africa occur on the eastern bank but fail to cross the river. These are the black rhinoceros, the Cape eland, Burchell's zebra, the five-horned giraffe, and the red-fronted gazelle. On the opposite bank we find an equally important assemblage of big game which are barred by the Nile from farther extension eastward. The most important of these species are the white rhinoceros, the giant eland, and the Congo giraffe. Living on both sides of the Nile and occurring in abundance we find such species as the Nile buffalo, Cape elephant, Nile kob, harnessed bushbuck, defassa waterbuck, Nile lechwi, yellow reedbuck, oribi, bush duiker, etc. All of these species, which are now found on both sides of the Nile, probably represent the older residents in the region, the more recent arrivals such as the rhinoceroses and elands having had less time to effect a crossing.

The Nile along most of its course is a really formidable barrier, being wide and lakelike in expanse, the margins boggy and overgrown by a heavy growth of papyrus and other aquatic plants which form an impassable barrier of floating *sudd*. Animals as large as elephants have been found mired and drowning in this treacherous plant growth. Between the Dufile rapids and Gondokoro the river is greatly narrowed, so much so that at a few spots it seems possible for large mammals to cross, but apparently they do not try the adventure, perhaps owing to fear of the swift current. It is evident from the presence of distinct genera of rhinoceroses on opposite banks that the Nile has been an open stream of considerable size for a great length of Tertiary time.

Natives of the Nile Nyika

The natives of the Uganda portion of the Nile are chiefly members of the Acholi and Bari tribes, who live in small stockaded villages and are agricultural. Lower down the river in the Sudan portion we meet with other tall, slender Nilotic peoples, like the Dinkas and Shilluks, who, like the Masai of the Rift Valley, are largely pastoral. These nude people protect themselves against mosquitoes by smearing their bodies with wood ashes, which gives them a weird and ghostly appearance.

The Highland Veld Zone

The highland veld zone may be described as the sportsman's paradise. It is a region of grassy plains, well watered by a moderate rainfall and

lying at altitudes of 4,000 to 8,000 feet. The climate is delightfully cool at night notwithstanding the torrid sun of the day. Great herds of game feed on the grassy plains and live there the year round. Cutting through this zone from north to south and dividing it into two sections is a great trough, the Rift Valley, of recent tectonic origin. The Rift Valley in British East Africa is bounded by two great escarpments which rise from 2,000 to 4,000 feet above the floor of the valley. The escarpments are forest-clad, in marked contrast to the grassy plains of the Rift Valley, with its numerous small lakes of independent drainage and often saline waters.

FIG. 8—Hippopotamus herd on the Tana River. (Photo by C. E. Akeley.)

Northward the Rift Valley descends rapidly from its culmination of 6,000 feet at Lake Naivasha to the low desert plains of Lake Rudolf, which is less than 1,000 feet in altitude. The Rift Valley with its independent local drainages separates the coast drainage from the Nile but is not a very important physical obstruction to game animals. A few antelopes, among which may be mentioned the lelwel hartebeest, the defassa waterbuck, the five-horned giraffe, the Uganda kob, and the sitatunga, find here their most eastern range, the last two species stopping on the Mau Escarpment west of the Rift but the first three mentioned passing this barrier and stopping in the Rift Valley itself. Proceeding westward from the Mau Escarpment the highland veld region continues over much of Uganda, occupying all of the basin of Victoria Nyanza and the lower slopes of the Ruwenzori massif. The Uganda veld is a region of tall grass and is quite devoid of plains-loving antelopes, being chiefly the haunt of buffaloes, ele-

phants, bush pigs, duikers, sitatungas, bushbucks, and other cover-haunting species.

Mammals of the Eastern Highland Veld Zone

Reverting to the British East African portion of the highland veld zone, which includes the Rift Valley and all the veld lying east of it in the coast drainage, we encounter as peculiar species the Thomson gazelle, the Coke hartebeest, the white-bearded wildebeest, and the diminutive steinbok. Bordering the rivers and streams which dissect the veld are scattered groves of green-barked, flat-topped, and other species of acacia. A remarkable type of tree which attains its perfection in the highland veld is the *Euphorbia candelabrum*, of weird, cactuslike appearance, leafless, and made up of angular succulent stems. It grows to gigantic size, often producing an immense globular branching crown as much as a hundred feet across and having a trunk several feet in circumference. No palms occur in this zone except a dwarf species of the wild date (*Phoenix*).

Masai, Kavirondo, and Baganda Tribes

In the old days the powerful cattle-keeping Masai, migrating southward along the pasture belts, occupied the Rift Valley and the highland veld of the coast drainage as well as the Laikipia and Athi Plains and also held sway far southward on the grassy slopes at the base of the lofty snow-capped Kilimanjaro. They were the lords of Equatorial Africa, until the rinderpest reached the continent, swept their cattle away, and so weakened their military power. They are a pastoral people and depend for food on the milk and blood of their herds, eating little or no vegetable matter nor the flesh of game animals. The ravages of the rinderpest in 1890 reduced their herds to remnants and their powerful standing army of warriors to a mere handful. The white man soon afterward entered the country and has now established himself securely in these pleasant highlands.

Living in the Nile drainage on the eastern shores of Victoria Nyanza are the Kavirondos, a tall, athletic, agricultural race who till the soil in fields won from the forests flanking the Mau Escarpment and the Nyanza plain. The Kavirondos live in that innocent state which prevailed in the Garden of Eden, but on the opposite side of Victoria Nyanza we find a well-clothed race, the Baganda, who have been subject to a dynasty for several centuries and have reached the state of culture which expresses itself in extreme forms of polite speech and servile deportment. These people, like most African tribes, are agricultural. Bananas and sweet potatoes are their staples of existence, and their dress consists often of bark cloth made from a tree common in the country.

The Highland Forest Zone

Bordering the highland veld on its upper levels we encounter the highland forest. There is no intermediate parklike country between

FIG. 9.

FIG. 10.

FIG. 9—Masai giraffe and Wakamba skinners, Athi Plains, Roosevelt expedition.
FIG. 10—Domesticated common eland in a Meru village.

forest and grass plains. The forest flanks the grass land as a solid wall quite as dense on its outer face as in its interior. How this sharp line of grass plains is maintained against the encroachments of the forest is a biological mystery. There is no burning of grass plains in this high region, the grass being short and the climate as a rule too wet for fires. The forest begins at an altitude of 6,000 feet and ranges up to 11,000 feet on the highest mountains such as Kenya and Ruwenzori.[5] Its quality is quite variable, the lower portions being composed of olive trees, albizzias (allied to acacias), crotons, the yellow-woods (African yew), *Podocarpus gracilior* and *P. thunbergii*, the Ibean camphor (*Ocotea usambariensis*). On dry slopes a large juniper (Kenya cedar) forms pure forests in places; on damp slopes giant tree ferns and fig trees are common. The upper levels of the forest are composed of an alpine bamboo, *Arundinaria alpina*, quite pure in growth, bordered at its upper limits by *Hypericum* trees, a close relative of the Saint-John's-wort of our gardens.

Mammals of the Highland Forest Zone

The East African mammals dwelling in the forest are bushbucks, red duikers, bush pigs, buffaloes, elephants, and leopards. Along with them are two very rare species which remained for many years unknown. They are the bongo (an elandlike antelope) and the giant pig. Both animals have recently come from the Congo by way of intervening forest areas. They have crossed the barrier of the Rift Valley from the Mau forests and now are found as far east as the slopes of Kenya, where they dwell securely in its dense forest covering. These two species have been prevented from reaching the extensive forests of Kilimanjaro by the lack of intervening forest belts.

Alpine Regions

Above the forest zone at 11,000 feet altitude on Kenya an open moorland or alpine region occurs, and this same type of country is found on the top of the Aberdare Range, on Kilimanjaro, and on the Ruwenzori Range. The ground at these high elevations is boggy and covered by alpine plants such as mosses, alchemillas, brambles, heathers, immortelles (*Helichrysum*), giant groundsels (*Senecio*), and lobelias of several sorts. The groundsels are gigantic forms and treelike in habit and very different from our own, which are insignificant roadside weeds. The very largest of the game mammals, the elephant, reaches this high range as a transient visitor, but is never resident at such an altitude. The buffalo is also an occasional intruder. Living in the zone is a race of the bush duiker and an occasional leopard and serval cat. Certain species of the rock hyrax are peculiar to this zone, and great numbers of small rodents and shrews make this lofty moist region their home.

[5] See note in "Geographical Record" for this month on "New Observations on Mount Kenya."—Edit. Note.

FIG. 11.

FIG. 12.

FIG. 11—Dry river of the nyika zone, bordered by dûm palms.

FIG. 12—Kavirondo field and hut, showing Kakamwega forest in the background. This is the eastern-most extension of the tropical Congo forest in Africa.

Tribes of the Mountain Forests

No true forest tribe occurs in the high mountain forests of eastern Equatorial Africa but we find dwelling there the Wandorobo people, helots of the Kikuyu and Masai tribes, who have taken to the forest, where they subsist on the game they catch in pits and on the stores of wild honey they

Fig. 13—Batian, the summit peak of Mount Kenya, 17,200 feet in altitude. Taken at snowline, 14,500 feet altitude.

find in trees. These people have no definite tribal organizations but live in small family communities: they probably represent remnants of older, subjected tribes. On the extreme lower edge of the forest bordering the grassy plains, in the Kenya region, we find several large agricultural tribes of whom the Kikuyu are the best known. They grow millet, sugar-cane, cassava, potatoes, maize, beans, squashes, and other vegetables. The activities of the Kikuyu bear an important relation to the forest and its wild life: constantly clearing new land in order that luxuriant crops may be obtained, they steadily encroach upon the forest. It has been estimated

FIG. 14.

FIG. 15.

FIG. 14—Alpine vegetation of Mount Kenya, growing at an altitude of 13,000 feet. Giant lobelias.

FIG. 15—Bamboo forest of Mount Kenya at its upper limit, 11,000 feet. In the foreground, immortelles in blossom.

that the forest belt of the Aberdare Range has recently been diminished at the rate of about half a mile yearly. On the forested slopes of Kilimanjaro, Mount Elgon, and the Ruwenzori Range are numerous other agricultural tribes similar in physical characteristics and habits to those of Kenya. These tribes are local in range, speak distinct languages, and have little intercourse one with another.

The Tropical Forest Zone and Its Mammals

A forest quite as dense as that of the high mountains but composed of tropical tree species is found occurring in patches through Uganda and as far eastward as the base of the Nandi escarpment. It is really a part of the great Congo forest, which sweeps across Africa from the west coast to the base of Ruwenzori. Large patches of tropical forest are found in Uganda on the shores of Victoria Nyanza: the easternmost outlier is the Kakamwega forest lying northeast of Victoria Nyanza in the basin of the Yalo River (foot of the Nandi escarpment). A great number of species of trees are found assembled in this tropical forest of Uganda. Many of the giant trees are figs, others are zapotes, but none are related to our own forest trees. The killer fig, which is parasitical on the trunks of trees in its youth and strangles them later, becoming a many-branched and many-stemmed tree, is a loathsome type common to the forest here. Palms are rare, but bananas of several species are abundant and replace them. Tree ferns also occur but are less numerous than in the highland forest. The Uganda forests were the highways by which the bongo and giant pig reached East Africa. These two species still occur in these forest bridges as well as in the great Congo forest itself. Besides these species there are elephants and several small forest duikers and bushbucks. Peculiar to the Congo forest but living on its eastern edge chiefly is the okapi, a recently discovered ungulate allied to the giraffes but very little known because of its secretive habits and the dense nature of its haunts. Also confined to this tropical forest but more widespread than the okapi are the chimpanzees. Their distribution practically coincides with the entire tropical forest area of Africa. Not so, however, does the range of the gorilla, which is limited to the Cameroons and Ogowe districts of the west coast and is absent from the whole Congo Basin. One species of gorilla is found in a small area of highland forest on the volcanic Mufumbiro mountains northeast of Lake Kivu. What is the explanation of the limited and widely separated distribution of the gorilla, the most powerful of the anthropoid apes, and the widespread range enjoyed by his smaller kin the chimpanzee?

The Tribes of the Congo Forest

Dwelling in the Congo forest proper there are several tribes of normal size of common Bantu stock, agriculturalists who are subject to a tribal

organization of considerable complexity; but the most interesting people in the Congo are the pygmies. They are a shy forest folk who avoid oppression by keeping aloof and away from their larger and more powerful negro neighbors as well as from the few white men who travel through their domain. In habits they resemble the okapi, with which they share their territory.

Summary

It is climate that exerts the chief control over the distribution of animals in Equatorial Africa. The five zones which we have here employed in defining the ranges of game animals and native tribes have been established on a climatic basis. Coincident with climate are distinctions of flora on which the animals are dependent for food and protection. Temperature first, and then moisture are the most important climatic elements. Temperature is dependent chiefly on altitude, and our zones, inasmuch as they are primarily defined by temperature, have very definite altitudinal boundaries and lie one above another. In accord with the banded orographical structure of the region we find the life zones disposed in ribbonlike arrangement and paralleling the coast in a general way the whole length of the eastern side of the continent. Summarizing the five life zones briefly (map, Fig. 1), we have first the narrow coast zone rising from sea level to 500 feet or so. Above this the great desert, or nyika, zone extends from 500 feet to an altitude of 3,000 feet. Above the desert the highland veld rises from 3,000 to 8,000 feet, its altitude giving it a cooler and moister climate. Rising still higher above the plateau there is a highland forest area on mountain slopes and summits covering the altitudes between 8,000 to 11,000 feet, where the climate is decidedly moister and cooler. The area lying above the tree zone, which is alpine in the character of its plant growth and climate, is infinitesimal in Africa in comparison with the other zones. In Uganda we have an area or zone, the tropical forest, which is dependent on soil conditions rather than altitude. Here we find a dense tropical forest covering certain areas within a grass veld region. To some extent this area is artificial, the grass veld having been extended by native agricultural methods at the expense of the forest area. Within these zones are two important river barriers, the Nile and the Tana, which subdivide the nyika zone, as their waters form important barriers to big game mammals. As a barrier these rivers are here only of great importance to the distribution of big game, smaller mammals being much less effected. Reptiles, birds, other animals, and vegetation are scarcely effected at all by these rivers in their distribution, though they are subject to the zonal or climatic barriers quite as much as are big game mammals. There is no region in the world where large mammals have been so limited in their distribution by rivers as in Equatorial Africa.

THE OUTLINE OF NEW ZEALAND

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A thorough appreciation of scenery involves not merely the perception of its beauty but also some understanding of its meaning in connection with the history of the earth. This meaning is not always perfectly obvious, but the real seeker is not dismayed by the difficulty of the quest. The shores of New Zealand are a veritable treasure house of beauty, rivaling in their charm the glaciers of the southern island, the geysers of the northern, and the mountains, lakes, and gorges of both. What story is it that these fascinating coasts reveal?

Peculiarities of the Coast Line

An examination of a map of the islands of New Zealand (Fig. 1) shows us a number of peculiarities in the outlines which demand explanation. The sprawling North Island and the more compact but narrow-waisted South Island suggest a decipherable coast history. Numerous embayments characterize certain areas as the loci of submergence; but, to the reader of an outline map, the intervening stretches of coast are generally enigmatical. Such portions, however, yield more information to the student in the field.

In a previously published article[1] the writer called attention to the occurrence of multicycle fault coasts, or, in other words, coasts initiated by faulting and subsequently uplifted intermittently during their modification by wave action and subaërial agencies.[2] It is proposed now to make a rapid survey in order to classify the coastal types represented.

The Broad Outlines

Geologic History

An investigation of the broad outlines of the New Zealand land masses necessitates an excursion into the realm of historical geology, and it becomes necessary to define what is to be understood by the name "New Zealand." To some it would mean not only the existing land but also any land that has ever been emergent on the site of the present New Zealand area; and this would be a perfectly justifiable view if it appeared that

[1] C. A. Cotton: Fault Coasts in New Zealand, *Geogr. Rev.*, Vol. 1, 1916, pp. 20-47.

[2] In the article referred to (p. 21) a somewhat misleading statement was made that fault coasts had not been recognized by geomorphologists of the American school. The statement was intended to refer to the non-recognition of the type in systematic classifications of coast forms in textbooks and similar works; but, as it stands, it does injustice to some workers, notably Vaughan and Lawson, who have indicated an origin by faulting for the coasts of Cuba and California respectively.

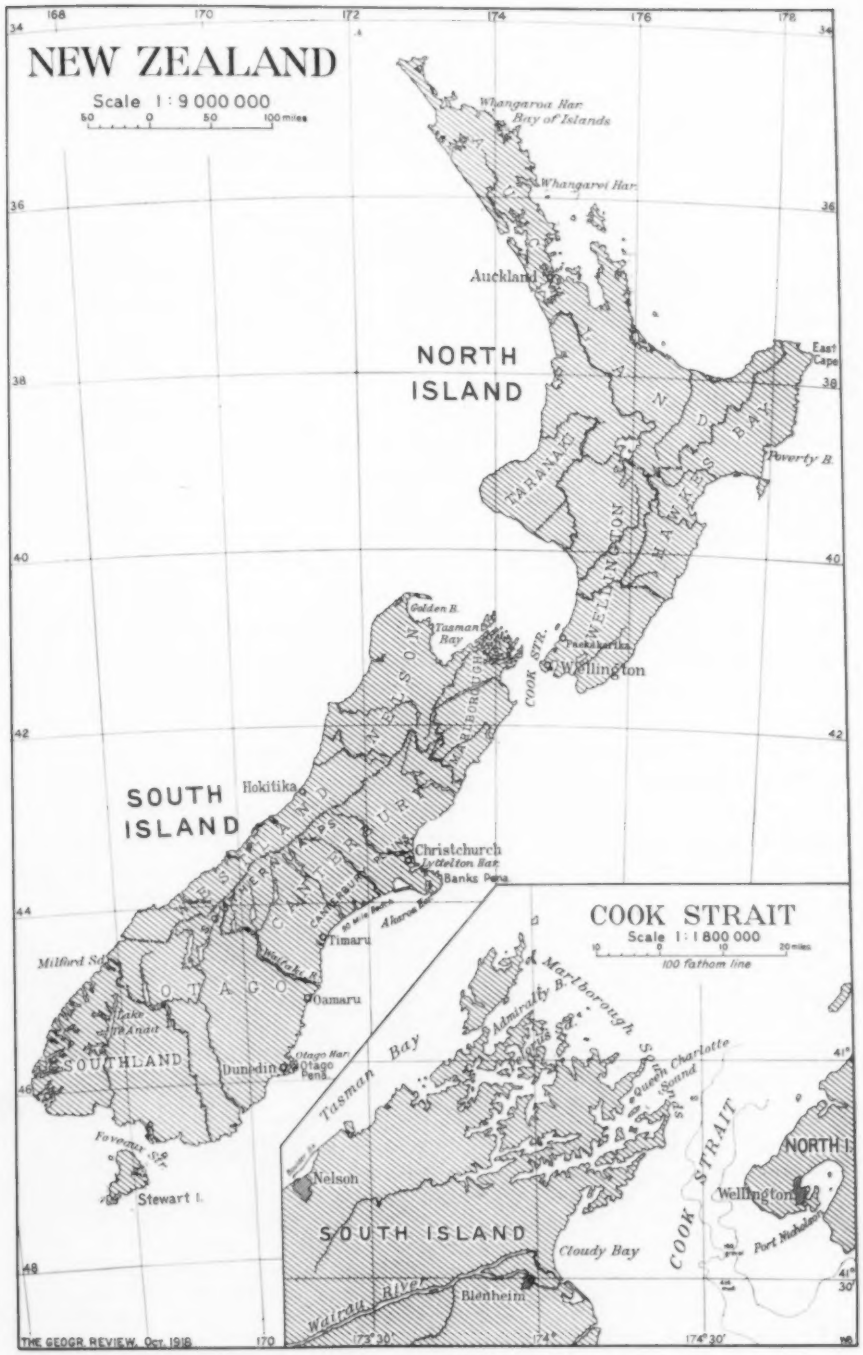

FIG. 1—Map of New Zealand showing the places and features mentioned in the text. Scale, 1:9,000,000. The inset, 1:1,800,000, shows the submarine channel of Cook Strait.

the axis of such land had always coincided more or less exactly with the axis of the present-day New Zealand—if, in other words, there were a recognizable nucleus about which the land had been built during a succession of submergences. But such is not the case.

In late Paleozoic and early Mesozoic times the site of New Zealand was the locus of accumulation of vast masses of coarse-grained sediments. An orogenic period followed, but nothing is known as to the extent of the resulting land except that it was of large dimensions. Its outlines are quite unknown, and it seems inadvisable to think of it as an ancestral New Zealand. Next followed a period of planation succeeded by Cretaceous and Tertiary sedimentation,[3] and it was only at the end of this that there arose, as a concourse of earth blocks, the initial forms of the present New Zealand land mass.[4] This, then, is New Zealand for the geologist, but its outlines were undoubtedly very different initially from those of the group of islands constituting the New Zealand of geography.

Present-Day New Zealand

To some small extent the present outlines may be survivals of the boundaries of the nascent land modified by later regional uplift and depression as well as by weather and waves. On the other hand some parts at least of the coasts are the sequential forms—generally multicycle sequential forms—developed from lines of fracture bounding a residual mass after marginal portions had foundered.[5] This foundering took place in relatively modern times, perhaps contemporaneously with some vertical movements by which the land has been divided into large differentially moving areas.[6] Prior to these coast-determining subsidences, though the area of the land was greater, its general outlines, especially in the south, may be assumed to have been roughly similar to those of modern New Zealand; for the axis about which the constituent earth blocks are heaped coincides in a general way with the trend of the existing land, and the low-lying blocks, generally speaking, are marginal.

Weak strata, deposited in the period immediately preceding the birth of the New Zealand land mass, survive over considerable areas on these marginal blocks because of the lowly position which they occupied with respect to base level during a long interval of less emergence than that of the present day. Their marginal occurrence led to a belief among early geological observers, who failed to note the evidence of more recent deformation, that these Tertiary strata were laid down around the coasts

[3] C. A. Cotton: The Structure and Later Geological History of New Zealand. *Geol. Mag.*, Decade 6, Vol. 3, 1916, pp. 243-249 and 314-320; reference on pp. 246-248. Reviewed in the *Geogr. Rev.*, Vol. 3, 1917, pp. 83-84.

[4] *Ibid.*, pp. 248 and 319-320.

[5] F. von Hochstetter: Geologie von Neuseeland, in "Reise der österreichischen Fregatte Novara um die Erde," Geol. Teil., I, Vienna, 1864, p. xlvi; E. Suess: The Face of the Earth (Engl. transl.), Vol. 2, Oxford, 1906, p. 144; C. A. Cotton, paper cited in footnote 1.

[6] C. A. Cotton, paper cited in footnote 3; reference on pp. 318-319.

and in the drowned valleys of a land surface carved by erosion from a folded range uplifted in the late Jurassic. The amount of submergence postulated to allow of the deposition of these younger strata was never sufficient, however, to allow of breaks in the continuity of the erosion of the axial mountain mass. Geologists of the latter half of the nineteenth century were not repelled by the idea of still-surviving, one-cycle Mesozoic mountains.[7]

The more modern explanation of the relief, which has been outlined on an earlier page, assigns the differential uplift of the more mountainous areas, as well as the emergence of marginal and intermont districts upon which are still preserved portions of the formerly widespread cover, to a period of uplift and deformation of very much later date—later, that is to say, than the period of deposition of the Tertiary sediments.

Recent Movements

All parts of New Zealand have been affected by recent vertical movements, and a fault coast depressed sufficiently, either as an accompaniment of or at any stage later than the initial faulting, loses most of its individuality as a fault coast and becomes scarcely if at all recognizable as such. It is thus difficult to determine whether all or only some of the outlines of New Zealand resulted from marginal foundering. No definite information on this point has been gained from a study of the continental shelf; but, if a number of variables can be given their proper value, a study of the width of the shelf ought to tell something of the time that has elapsed since the initiation of the coast of which it forms a part. Nothing, however, can be more striking than the rapidity, judged by the rate of contemporaneous subaërial erosion, with which a normal, graded shelf is developed in connection with a young coast.[8]

Cook Strait

New Zealand consists of two main islands and a few smaller ones. To a New Zealander the two large islands are the mainland of his country. So closely are they related that they have not really separate names. On a map they appear as "North Island" and "South Island," but they are spoken of as "the North Island (of New Zealand)" and "the South Island

[7] The following passage from Hutton is quoted with approval by Suess: "Mountains with sharply jagged peaks are the exception in Switzerland, and the rule in New Zealand. Waterfalls are rare in New Zealand; a few occur up the deep fjords of the south-west coast, and some few small ones at the heads of the valleys in the great ranges. Yet the Alps of New Zealand are quite as bold and steep as those of Switzerland; their ravines are even more numerous and deeper. The passes are deeper in New Zealand, the valleys much more terraced, and the mountains on the whole more extensively covered by loose débris than in Switzerland. This is certainly truer of Canterbury, Nelson, and Marlborough than of Otago. The explanation lies in the fact that the Alps of New Zealand are *by far the older*. They have been exposed to the action of the weather, at least in part, since the Jurassic period, and many of the larger valleys were already excavated, almost to their existing depth, before the Oligocene period." (E. Suess *op. cit.*, p. 148.)

[8] C. A. Cotton, paper cited in footnote 1; reference on p. 37.

(of New Zealand)." It is as though one spoke of "the northern part" and "the southern part" of a country.

Origin of Cook Strait

The close political association of the two islands is a result, no doubt, of their isolation from the rest of the world: it has come about in spite of striking physical differences between them—differences which lead to an inquiry as to the origin of the dividing strait. The origin of this channel, Cook Strait, has been ascribed to (1) subsidence, with drowning of the valley of a great river; (2) dislocation; and (3) subsidence of earth blocks.

The River Theory

The first of these, the Cook Strait River theory, was advocated by Crawford.[9] Hutton[10] also ascribed the separation of the islands to regional subsidence. The theory is inadequate, as it involves a great subsidence of all the land bordering the strait, while it is only locally that there is any evidence of subsidence, the most general movements having been of uplift.

The Fault Theory

The dislocation, or Cook Strait Fault, theory was put forward by Hochstetter[11] but afterwards abandoned. It was revived by Park.[12] According to Hochstetter—

> In the early geological era of New Zealand we may assume that both islands were connected and that one backbone ran continuously from the South Cape to the East Cape. In the present map of New Zealand the integrity of this backbone is broken at Cook's Straits, and a closer inspection will show that there has been not only a simple break of continuity, but a lateral dislocation . . . . . It is evident, from the rocks being of the same geological formation, that at one period the Pelorus ranges were a continuation of the Wellington ranges. The position of the strata in the eastern ranges of Nelson proves that, whilst the Northern island seems to have remained stationary, some gigantic force has pressed the great mass of the Middle [South] Island to the westward.

Park states that the "North Island has been thrust eastward some distance relatively to the South Island." Of this relative movement of some fifty miles there is no satisfactory field evidence, and the theory has nothing to recommend it.

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[9] J. C. Crawford: Did the Great Cook Strait River Flow to the Northwest or to the Southwest? *Trans and Proc. New Zealand Inst.*, Vol. 7, 1875, pp. 448-451.

Idem: Some Further Proofs as to the Ancient Cook Strait River . . . . also a Consideration of the Date at which the Islands were United, *ibid.*, pp. 451-453.

[10] F. W. Hutton: The Geological History of New Zealand, *Trans. and Proc. New Zealand Inst.*, Vol. 32 1899, pp. 159-183; reference on p. 178.

[11] F. von Hochstetter: Lecture on the Geology of the Province of Nelson, in "The Geology of New Zealand," by Hochstetter and Petermann, Auckland, 1864, pp. 77-108; reference on p. 106 (first published in *New Zealand Government Gazette*, 1859).

[12] J. Park: Geology of New Zealand, Christchurch, 1910, p. 262.

The Subsidence Theory

Hochstetter's later theory to account for Cook Strait as the result of subsidence of earth blocks was stated as follows:

> Indem aber das Land durch Hebung, durch Anschwemmung und durch das Hervorbrechen der Vulcane einen nicht unbedeutenden Zuwachs erhielt, versanken andere Theile gleichzeitig in die Tiefe. Einem solchen Ereignisse mag die Bildung der Cooks- und Foveaux-Strasse ihren Ursprung verdanken.[13]

Hochstetter no longer felt the necessity of assuming lateral dislocation, for, as Suess points out, he was now "aware that the mountain chain which follows the east coast of North Island from East Cape to Wellington is continued on the other side of Cook Strait between the east coast of South Island and the river Awatere."[14]

When the evidence is recalled of great differential movement between adjacent blocks on both sides of the strait, both in the mountain-building period and in the later period of vertical movements, it seems highly probable that this explanation of the formation of Cook Strait is the correct one. Possibly the statement ought to be modified by substituting for the phrase "subsidence of earth blocks" another reading "failure of blocks to rise along with the adjacent blocks which now constitute the northern part of the South and the southern part of the North Island." There is, however, a biological argument in the identity, or at any rate close affinity, of northern and southern species of moas for the belief that the dry land areas of the two islands were at one time connected,[15] though, according to Hutton, the differences in these flightless birds are such as to lead him to believe the period of separation to be rather ancient. This justifies the adoption of a tentative hypothesis that at the close of the orogenic movements which gave birth to the New Zealand land mass the dividing strait was not in existence and that the separation of the two islands has taken place subsequently as a result of a subsidence of blocks possibly contemporaneous with the partial subsidence of an adjacent portion of the South Island.

Evidence in Support of This Hypothesis

Important evidence of subsidence in the southern entrance to the strait is afforded by a channel of deep water extending into the narrows of the strait, where it is kept open by the strong scour of tidal currents. In this trench the British Admiralty chart[16] records a depth of 414 fathoms, with a mud bottom, but in 160 fathoms the presence of gravel is noted (Fig. 1, inset). In the northwestern open part of the strait, on the other hand, the maximum depth is only about 60 fathoms, for tidal currents are there too feeble to prevent the deposition of sediment in deep water. There is, therefore, a level mud bottom altogether masking the initial form of the floor.

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[13] F. von Hochstetter, work cited in footnote 5, p. xlvi.
[14] E. Suess, *op. cit.*, p. 144.
[15] F. W. Hutton, *op. cit.*, p. 177.
[16] No. 2054 (New Zealand, Sheet 5)

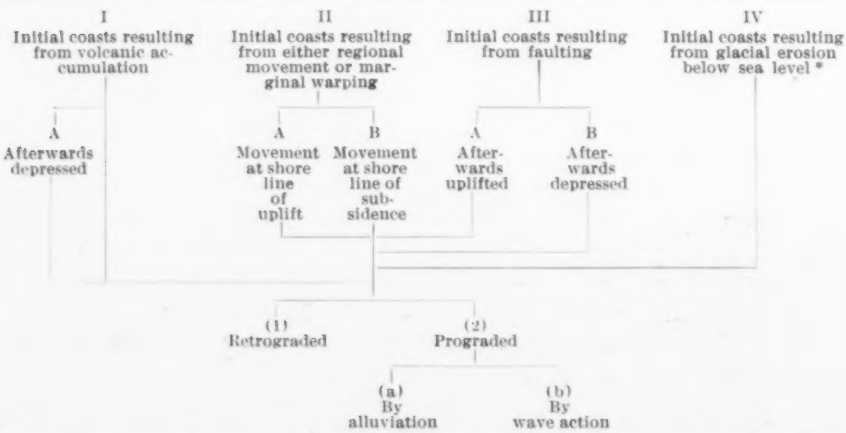
It may be noted in this connection that central New Zealand is a seismic region and that the majority of recorded shocks have been shown to proceed from points beneath the northwestern entrance of Cook Strait.[17] This perhaps indicates that subsidence along faults is still in progress.

The Existing Coasts of New Zealand

The outlines of the two main islands have thus been roughed out largely by fracture, with foundering of land to seaward; but the actual coasts, whether originating entirely in this way or preserving some parts of the outline of the initial land, are sequential forms modified as a result of emergence and submergence, retrogradation and progradation.

The following tabular classification of coasts has been found useful by the writer in making a preliminary diagnosis of the coastal types represented.

TABULAR CLASSIFICATION OF COASTS



* G. K. Gilbert: Glaciers and Glaciation (Vol. 3 of Harriman Alaska Expedition), New York, 1904; reference on pp. 210-218.

NEW ZEALAND COAST TYPES

Almost every conceivable type of coast has its representative somewhere in New Zealand's long coast line; but the principal types are as follows:

(1) Drowned coasts, the presubmergence form being generally indecipherable, but, from analogy, probably of the fault-coast type, II B, III B (1, 2).

(2) Drowned volcanic coasts, I A (1, 2).

(3) Fault coasts, all or nearly all subsequently uplifted and, therefore, multicycle fault coasts, III, III A (1, 2).

(4) Prograded coasts, 2 (a, b).

[17] See Map of Earthquake Origins, by G. Hogben, in Patrick Marshall: The Geography of New Zealand, Christchurch, 1905(?), Fig. 10, p. 219.

The Coasts of the North Island

Northern Part

The northern half of the North Island has been affected by broad regional subsidence. The evidence of land forms, however, shows that this

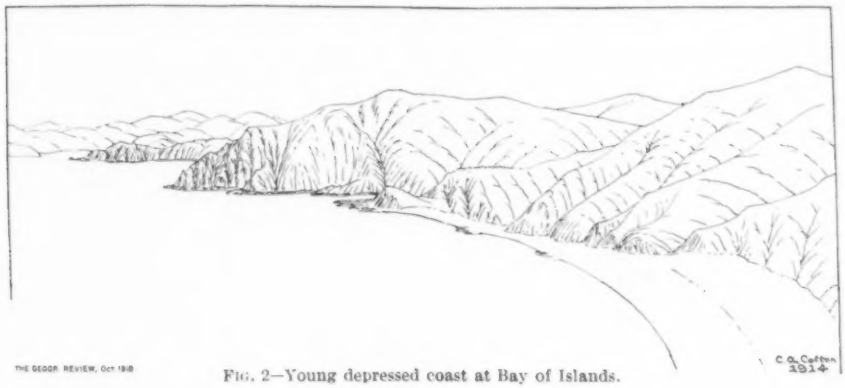


Fig. 2—Young depressed coast at Bay of Islands.

subsidence is not of great amount and that it followed still greater uplift. It would appear from the depth of water not far from the coasts that this subsidence affected a land mass roughed out previously to a shape very

Fig. 3—At Bay of Islands, northern New Zealand.

similar to that of the present land. A long period of erosion followed the roughing out of the initial coast, and so the subsidence has given a typically drowned shore line, which is now, especially on the eastern coast, still in a young stage of development (Figs. 2-6).

On the western coast, upon which great seas are continually breaking, a long, straight shore line has been developed, in part by the cutting back of headlands but principally by progradation, enormous quantities of sand having been thrown up as beaches, spits, and bars and piled as dunes upon

FIG. 4—Whangarei Harbor, northern New Zealand.

the foreland. This even coast is broken here and there by inlets which are the openings of drowned valley systems extending far inland. Progradation and dune formation along this coast have not been confined to the

FIG. 5—Whangaroa Harbor, northern New Zealand. (Photo from New Zealand Dept. of Tourist and Health Resorts.)

present cycle of coastal evolution, for there is a strip of soft sandstone of eolian origin with pronounced cross-bedding which must have accumulated on an advancing shore line in the period anterior to the recent submergence of the valleys that cross it and anterior also to the earlier uplift

that led to the excavation of those valleys and the mature dissection of the eolian sandstone.

This type of coast extends southward along the west coast almost to the great salient of Taranaki; while on the east coast the drowned coast reaches to Poverty Bay.

FIG. 6—The upper reaches of Auckland Harbor.

SOUTHERN PART

In the southern part of the North Island shore lines resulting from recent subsidence are not found except locally at Wellington; and, as in the north, the land forms afford evidence of a series of movements of uplift.[18] It is not clear whether the whole of this intermittent uplift is to be correlated with the uplifts which preceded the valley-drowning subsidence in the north. Possibly the later stages of the uplift in the south took place contemporaneously with the northern subsidence, in which case the latest and most important movement in connection with the origin of the existing coasts might be regarded as a tilting of the whole island on a hinge line about midway between the extremities. This has not, however, been established, and the effects have probably been produced by movements of a less simple character.

The eastern and southern coasts may be classed as multicycle fault coasts (Figs. 7 and 8), but the latter is interrupted by a locally downwarped and embayed area occupied by Port Nicholson, the harbor of Wellington (Fig. 11).[19] That of western Wellington appears to be a mature fault coast also, but differs from the others in being prograded except at the southern end (Fig. 9). A number of features in connection with the coastal lowland bordering this coast point to alternation on a large scale between progradation and retrogradation in the period that has elapsed since the last significant movement of uplift.

The first decipherable stage in the history of the development of this western coast is a phase of retrogradation during which a mature line of

[18] C. A. Cotton: Notes on Wellington Physiography, *Trans. and Proc. New Zealand Inst.*, Vol. 44, 1911 pp. 245-265.

[19] C. A. Cotton, papers cited in footnotes 1 and 18.

cliffs was developed on the old rocks forming the core of the land. Except at the southern end of the coast, however, a foreland compounded of several elements (Fig. 10) and varying in width up to about twelve miles, now lies in front of the ancient cliffs. The material composing the foreland is of two kinds, gravel of local origin and sand which has been transported alongshore from the north. The abundance of the latter at certain times seems to have been the cause of progradation, and reversals of the process seem to have resulted from fluctuation in the supply. The sand thrown up by the sea in the first progradational phase formed, apparently,

FIG. 7—Cliffs of the southern coast of Wellington. Note the talus that has accumulated along the base of the cliffs since the small uplift of 1855.

a dune-covered foreland, while the gravel supplied by local streams would accumulate on the foreland as fans. When the foreland grew wide, the irregular surface seems to have been planed or reduced to an even seaward slope by subaërial erosion, the sand, no doubt, first becoming fixed by vegetation, as is the case on modern dunes along this coast. Then came a phase of retrogradation. At its narrow southern end the foreland was at this time cut away practically altogether, and farther north the seaward margin of the planed dunes was cut back to such an extent that revived streams dissected the sloping surface. A second extensive progradation has built a new dune-covered foreland several miles in width, between which and the margin of the older foreland (and especially in the valleys of the latter) there are some lakes and swamps, while in places the newer dunes, now fixed by vegetation, interfinger with the spurs of the older foreland. The existing gravel fans have been built in the later main progradational phase.

At the narrow southern end of the foreland, where the intermediate phase of strong retrogradation has only recently been terminated by the southward growth of the newer foreland along the coast, there are strongly marked features illustrating the four main phases in the oscillation of the shore line. The cliffs of the first retrogradational phase are now somewhat subdued and rounded by soil creep, and pass by a smooth concave curve at the base into the talus slopes and fans of the next phase—the first progradation (Fig. 13, fans on left). These fans are irregularly truncated by the cliffs developed in the second retrogradational phase, which, in

FIG. 8—An uplifted platform of the multicycle fault coast of southern Wellington.

places, are cut back far enough to intersect the line of the older cliffs (Fig. 13, center). In front of the newer line of cliffs lies the modern foreland, consisting of a belt of dunes, which are fixed on the landward side by vegetation and which enclose between them and the cliffs a narrow strip of marshy plain.

The Coasts of the South Island

NORTHERN COAST

Golden Bay and Tasman Bay, which are deep re-entrants in the northern coast, appear to be areas of subsidence connected with the Cook Strait depression. Along their shores there is evidence of uplift and also of some subsidence, the latter movement being the more recent. Thus the coast is more or less drowned, and still young, though straightened to some extent by the growth of sand and gravel spits and to a smaller extent by cliffing.

FIG. 9—The shore of Cook Strait, southwestern coast of Wellington.

FIG. 10—Extreme southern end of the foreland of western Wellington, backed by the cliffs of Paekakariki.

At the head of Tasman Bay confluent deltas of several rivers form extensive plains, while, near the head of the bay on its eastern side, an interesting feature is Nelson Haven, a sheltered harbor enclosed by a spit of coarse gravel and boulders up to the size of a man's head and even larger. This spit extends for eight miles along the shore southwestward from a high, cliffed bluff from which the rock material is derived and encloses a strip of water one to two miles in width (Fig. 12). The natural entrance to the harbor around the hooked southern end of the spit is shallow and rocky, but an opening has recently been cut artificially through

FIG. 11—Young depressed coast of the Port Nicholson (Wellington Harbor) area of local subsidence.

the natural breakwater. Considered as a spit the "Boulder Bank," as it is called, is of interest on account of the coarseness of the material of which it is built.

The drowning of the coast is very pronounced on the east side of Tasman Bay in the area known as the Marlborough Sounds, where rias penetrate far inland among mountains 2,000 to 4,000 feet in height (Fig. 14).

To the southeast there is then an abrupt transition to an uplifted district (eastern Marlborough) separated from the Sounds district only by the delta of the Wairau River (which is built into Cloudy Bay, a branch of the Cook Strait depression). The eastern Marlborough coast has been ascribed by the writer to the multicycle fault-coast type.[20]

EASTERN COAST

Farther southward along the eastern coast of the South Island the features characteristic of very recent uplift fail and are replaced by others

[20] C. A. Cotton, paper cited in footnote 1, pp. 33-41.

FIG. 12—The Nelson Boulder Bank.

indicating subsidence, particularly at Banks Peninsula. The same subsidence is known to have affected the adjacent parts of Canterbury, but the coastal features characteristic of subsidence are limited to Banks Peninsula, as the adjacent coasts are strongly prograded. Banks Peninsula (Figs. 15 and 16) forms a very prominent salient beyond the seaward margin of the Canterbury Plain. Originating as an island formed by a cluster of volcanoes that has been dissected and depressed, it is now tied to the shore line of the plain by the growth of bars of gravel from the south

FIG. 13—Fans at Paekakariki, western Wellington, built in front of an ancient coast and afterwards cut back by the sea. In front of the newer line of cliffs lies a strand plain.

and of sand from the north, the great lagoon enclosed between which has been partly filled, with the formation of a large area of low-lying land.[21]

BANKS PENINSULA

The two largest of the drowned valleys of Banks Peninsula are the harbors of Lyttelton and Akaroa (Fig. 17). They penetrate into the hearts of the two main volcanoes of the complex and are enlarged to great basin-like hollows owing to the monoclinal retreat of the inward-facing escarpments of the lava sheets. Speight,[22] therefore, retains for them the term *calderas*, applied by Von Haast.

CANTERBURY PLAIN COAST

The Canterbury Plain is made up of confluent gravel deltas,[23] and its shore line has advanced seaward owing to accumulation being more rapid

[21] Julius von Haast: Geology of the Provinces of Canterbury and Westland, New Zealand, Christchurch, 1879, pp. 400-401.

[22] R. Speight: The Geology of Banks Peninsula, *Trans. and Proc. New Zealand Inst.*, Vol. 49, 1917, pp. 365-392.

[23] Julius von Haast, *op. cit.*, p. 396.

than subsidence. Southwards of Banks Peninsula the plain is fringed by the Ninety Mile Beach, the northern end of which forms the isthmus that ties the peninsula to the plain on the southern side. Abundant gravel brought down from the Southern Alps by the rivers that cross the Canterbury Plain travels northward along the shore line and causes progradation in an increasing degree towards the peninsula, which arrests further movement of the gravel. One after another the drowned valleys on the south side of the peninsula are being cut off from the ocean by gravel bars. Lake

FIG. 14—In Queen Charlotte Sound, Marlborough Sounds district.

Forsyth, the largest of these and the last to be closed, is said to have been sufficiently open to be useful as a boat harbor in the early part of the nineteenth century, though now closed and converted into a brackish lake[24] (Fig. 16).

TIMARU

The northward drift of gravel along the shore line is still prominent at the southern end of the Canterbury Plain, much gravel being brought down by the Waitaki River farther south. The gravel drift is made manifest at Timaru owing to the obstruction caused by the harbor works. When the construction of an artificial harbor at Timaru was first contemplated it was proposed to have it some distance out from shore in order to allow the gravel to travel past along the beach. This scheme was not adopted, however, and a harbor was enclosed between two curved breakwaters extending out from the shore. In a few years the obstruction thus formed had caused a broad prograded strip to grow on the southern side, the har-

[24] R. Speight, *op. cit.*, p. 370.

bor was rapidly being filled up, and it was found necessary to run a new wall straight out seaward as a "shingle trap." In the future, further extension of this wall will probably be required. One curious result of the

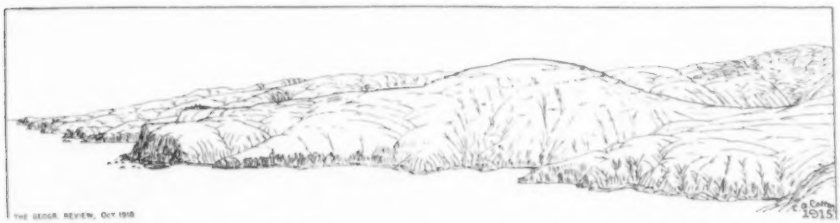


FIG. 15—The northern side of Banks Peninsula. The entrance to the harbor of Lyttelton lies beyond the first headland.

stoppage of the movement of gravel along the shore is that the beach immediately under the lee of the harbor works, known as Caroline Bay,

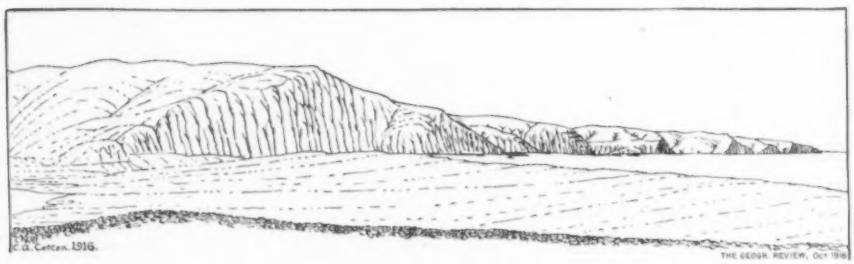


FIG. 16—The southern side of Banks Peninsula, from a gravel ridge on the Ninety Mile Beach. The recently closed bay, Lake Forsyth, is on the left.

which was formerly part of the gravel beach, is now covered with sand, being the only sandy beach for many miles. The possession of this beach has converted Timaru into a summer resort.

OAMARU AND OTAGO

Southward of Timaru the delta of the Waitaki repeats the features of the Canterbury Plain coast, while beyond it, at Oamaru, a mature cliffed coast begins, cut on weak rocks with moderate relief and fringed by a narrow strip of coastal plain, now cut back to cliffs some forty feet in height. The accumulation of the young littoral sediments of this strip marks a period of downward oscillation preceding the small uplift which was the last movement and which laid bare the narrow coastal plain and initiated the retrogradation that has reduced it to a discontinuous terrace.[25]

[25] This is the "42 ft. raised beach" of Park (J. Park: The Geology of the Oamaru District, North Otago, *New Zealand Geol. Survey Bull. No. 20* (*N. S.*), Wellington, 1918, pp. 19 and 112). The so-called "12 ft. raised beach" is the platform and bed of gravel at the base of the young coastal plain sediments.

FIG. 17—Port Lyttelton, Banks Peninsula.

Farther south a young drowned coast is again prominent, the maximum of embayment being found on the volcanic massif of Otago Peninsula. Here is a great quantity of sand traveling northward along the shore, which has more or less completely closed the inlets (Fig. 18), Otago harbor being the only one that is navigable. Otago harbor results from the drowning of two valleys and the divide between them, but one entrance to the strait thus formed is now closed by a sand isthmus connecting Otago Peninsula with the mainland.[26] Upon the isthmus part of the city of Dunedin is built.

Foveaux Strait and Stewart Island

The coast line for some distance southwestward from Otago Peninsula is practically mature, but as Foveaux Strait is approached embayments again appear, probably partly as a result of the slower rate of erosion in more sheltered waters. Stewart Island, as well as the opposite mainland shore, is deeply embayed, and Foveaux Strait, which lies between, may be due entirely to general subsidence, though it is quite possible that a strait had been formed by local subsidence, as Hochstetter supposed,[27] prior to the general subsidence. The deep indentations of the eastern side of Stewart Island form fine harbors, but the exposed, western coast has been much straightened by the cutting back of headlands and the filling of bays with sand.

Western Coast

The western coast of the South Island has been shown to be at least in its

[26] Patrick Marshall: The Geology of Dunedin (New Zealand), *Quart. Journ. Geol. Soc.*, Vol. 62, 1906, pp. 381-424; reference on p. 384.

[27] F. von Hochstetter, work cited in footnote 5.

northern part one of those rather recently uplifted and subsequently cut back by erosion.[28]

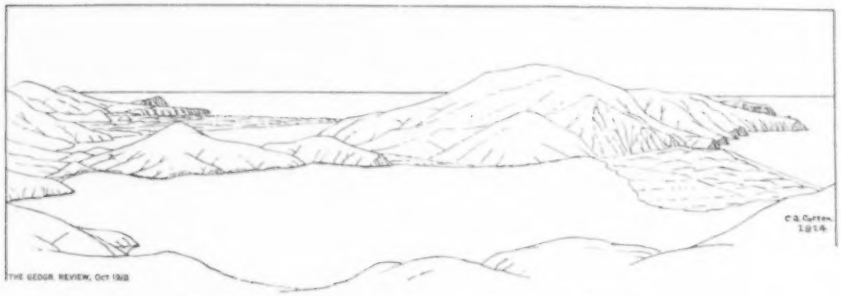


FIG. 18—Embayments closed by sand bars, Otago Peninsula.

This coast bounds a group of high faulted blocks, and its original outline was probably determined by a fault line. The present maturity of

FIG. 19—View looking up Milford Sound, the finest of the New Zealand fiords. Stirling Fall (500 ft.) spouts from the mouth of a hanging valley on the extreme left, and the sheer precipice beside it is 3,000 feet high.

outline and high, bold cliffs of the west coast are to be largely ascribed to

[28] J. A. Bartrum: The Geological History of the Westport-Charleston High-level Terraces, *Trans. and Proc. New Zealand Inst.*, Vol. 46, 1913, pp. 255-262.

the enormous energy of the waves driven before the westerly winds of the "roaring forties." The supply of waste from the mountains is so great, however, that parts of the coast are prograded in spite of the great energy of wave action. Recent inroads made by the sea on the town of Hokitika, which is built on a strand plain, point to alternation between periods of progradation and retrogradation similar to those noted on other sections of the New Zealand coasts.

The Fiord District

In the southwestern, or fiord, district the deep offshore soundings and the sweeping curve of the shore line seem to indicate without doubt a fault origin for the outer coast. This is suggested in a map by Park.[29] The occurrence of high benches which appear to be cut platforms suggests a multicycle origin. Much has been written about the fiords or "sounds" of this section of the coast,[30] which resemble the fiords of Norway, and it is not proposed to discuss them at length here. The existing features of the fiords are clearly of glacial origin. What remains in doubt is the origin of the preglacial valleys, whether these were insequent, fault-guided, or tectonic. It may be noted that the generalization emphasized by Gregory in a recent publication,[31] that the most typical fiords are straits parallel with the coast, does not hold for New Zealand, where there are no longitudinal fiord straits, unless the inland "fiord" Lake Te Anau be regarded as taking the place of these.

[29] J. Park, work cited in footnote 12, p. 265.
[30] See especially J. W. Gregory: The Nature and Origin of Fiords, London, 1913, pp. 350-368.
[31] J. W. Gregory: Fiords and Earth Movements, *Scientia*, Vol. 20, 1916, pp. 253-264.

THE SLAVS OF SOUTHERN HUNGARY*

By B. C. WALLIS

[With three separate maps, Pls. XIV–XVI, facing p. 352.]

The Slavs of southern Hungary include those Hungarians who belong to the group of Yugo-Slavs (Southern Slavs). They live in Croatia-Slavonia and four counties of Hungary proper (see Fig. 2). Croatia-Slavonia consists of, first, the lower and Hungarian portion of the mesopotamian land between the Save and the Drave, the great Danubian tributaries which flow from the Eastern Alps, and, secondly, that portion of the Dinaric Alpine region which fringes the hundred-mile strip of the Hungarian coast on the Adriatic Sea. The four counties of Hungary proper are grouped here under the title of South-Slav Hungary; they are Baranya, west of the Danube and north of the Drave; Bács-Bodrog (the Báceska), between the Danube and the Tisza; and the two counties of Torontál and Temes, which form the western Banat.

The Yugo-Slavs

The Yugo-Slavs—other than their eastern division, the Bulgarians—include three peoples, the Slovenes (most of whom live in Austria), the Croats, and the Serbs. The Croats are distinguished from the Serbs by two characteristics—they are Roman Catholics and use the Roman alphabet, while the Serbs are members of the Eastern Church and use Cyrillic characters. In the early censuses the only official method of separating Serbs from Croats was based upon their religion; one of the many refinements of the later censuses is to separate them on the basis of mother tongue and to distinguish the Sokáczes and Bunyeváczes of South-Slav Hungary separately from the Serbs, mainly on the ground that they are Roman Catholics. For purposes of historical comparison it is necessary to group the Serbs and Croats together as Serbo-Croats. The Roman Catholic Serbs live in Baranya and the Báceska. It is not clear how the Serb is distinguished from the Croat on the basis of speech, as both peoples use the same language.

Population and Area

The total population of Yugo-Slav Hungary in an area of 30,000 square miles amounts to 5,000,000, as many people as there are in Rumanian Hungary, as defined in the first article, in an area of 38,000 square miles. The density of population is the same as the average density of the popula-

*This is the third of a series of four articles. The first two, "The Rumanians in Hungary" and "The Slavs of Northern Hungary," appeared in the August and September numbers of the *Review*. The last, "Central Hungary: Magyars and Germans," will appear in the November number. An explanatory note on the maps accompanies the first article.—Edit. Note.

tion in Hungary as a whole (see Table I in the first article, p. 157). In area the country of the Yugo-Slavs is therefore equal to South Carolina and in population to Ohio.

South-Slav Hungary contains eight municipalities, of which the largest, Szabadka (with 95,000 people and 244,000 acres), is the third largest town in Hungary (cf. Duluth, with 94,000 people and 55,000 acres). The other municipalities, in order, are: Temesvár (with 73,000 people and 21,000 acres; cf. Harrisburg, Pa., with 72,000 people and 3,000 acres), Pécs (50,000), Újvidék (34,000), Zombor (31,000), Versecz (27,000), Baja (21,000), and Panesova (20,000). Croatia-Slavonia contains four municipalities: Zágráb, the capital (with 79,000 people and 17,000 acres; cf. Manchester, N. H., with 78,000 people and 20,000 acres), Eszék (31,000), Zimony (17,000), and Varasd (13,000). The port of Fiume, though geographically part of Croatia-Slavonia, is administered as a separate portion of Hungary proper; it contains 50,000 people in an area of 5,000 acres. Nearly half the inhabitants are Italians, one-eighth are Magyars, and a quarter are Croats. The surrounding district is peopled by Croats (cf. Pl. XV).

The People of Southern Hungary

The 5,000,000 inhabitants are almost equally divided between Croatia-Slavonia and South-Slav Hungary. During the decade 1900-1910 the natural increase of the population in South-Slav Hungary was two-thirds that of Croatia-Slavonia, while the emigration from the Hungarian area was at a slightly faster rate than that from the mesopotamian land. Both areas received a small inflow of people from other parts of the kingdom. In comparison with Rumanian Hungary, Croatia-Slavonia had a greater natural increase, while South-Slav Hungary had a smaller natural increase, than either of the Rumanian areas. The emigration from both the Yugo-Slav districts exceeds that from the Rumanian Forelands, and that from Croatia-Slavonia was at an equal rate with the emigration from Transylvania.

Table I—Population Changes in Southern Hungary, 1900-1910
(*Population in thousands*)

	Total population		Net increase (b)-(a)	Excess of births over deaths	Change (c)-(d)	Estimated net emigration	Migration within Austria-Hungary
	1900	1910					
	(a)	(b)	(c)	(d)	(e)	(f)	(g)
South-Slav Hungary							
Thousands	2,187	2,281	94	197	−103	−119	16
Per cent	....	....	4.2	8.9	4.7	5.5	0.8
Croatia-Slavonia							
Thousands	2,455	2,672	217	328	−111	−112	1
Per cent	....	....	8.5	12.8	4.3	4.3	...

In comparison with the Northern Slavs the natural increase of the Southerns Slavs is small; the purely Slav country of Croatia-Slavonia had a lower rate than Ruthenia or Ruthenian Slovachia, while South-Slav Hungary, an area of several peoples, had a smaller increase from natural causes than Slovachia. Emigration from the south did not attain the magnitude of that from the north, although the southern population is 25 per cent more numerous; the chief cause of the difference was the exceptional emigration from Ruthenian Slovachia. The internal migrations were also smaller than those of the north. It may, therefore, be concluded that Croatia-Slavonia was in a fairly settled state, like Ruthenia and Transylvania, while South-Slav Hungary tended rather towards the unsettled condition which characterizes the Slovak lands.

The percentage increase in population between 1880 and 1910 confirms this conclusion (Table II). The 40 per cent increase for Croatia-Slavonia lies between the increases for the Transylvania (28 per cent) and Ruthenian districts (54 per cent), and the 22 per cent increase for South-Slav Hungary is equivalent to that for Slovachia.

The people of Yugo-Slavia are Serbo-Croats, Magyars, and Germans, with a small number of Jews. In South-Slav Hungary the Magyars have increased steadily since 1880 and now form a relative majority of the population; the Germans were slightly more numerous in 1910 than in 1880 but suffered absolute losses in numbers during the last two decades; the Serbo-Croats were less numerous in 1910 than in 1880 (Fig. 1).

TABLE II—NATIONALITIES IN SOUTHERN HUNGARY, 1880 AND 1910

NATIONALITY	SOUTH-SLAV HUNGARY			CROATIA-SLAVONIA		
	1880	1910	INCREASE PER CENT	1880	1910	INCREASE PER CENT
Thousands	1,859	2,281	22	1,913	2,672	40
Density per square mile	90	111	...	72	100	...
SERBO-CROATS						
Thousands	454	444	—2	1,716	2,288	33
Percentage	24	19	...	89	85	...
MAGYARS						
Thousands	489	736	50	40	107	168
Percentage	26	32	...	2	4	...
GERMANS						
Thousands	562	627	11	76	128	68
Percentage	30	28	...	4	5	...
JEWS						
Thousands	39	43	10	13	22	69
Percentage	2	2	...	1	1	...

The curve for the Serbo-Croats in South-Slav Hungary (Fig. 1) is in striking contrast with the corresponding curve in Croatia-Slavonia and resembles the curve for the Germans between the years 1890 and 1910. Consequent upon these losses of Serbo-Croats and Germans the rate of increase of population in South-Slav Hungary fell away notably from decade to decade; a similar decline is indicated by the curves for the Slovak districts (Fig. 1, p. 271).

In Croatia-Slavonia five people out of six are Serbo-Croats; their numbers have steadily increased, although the rate of increase was slower than those of the small minorities of Magyars, Germans, and Jews.

Serbo-Croats in General

As in the case of the Rumanians and the Ruthenians of Hungary with regard to the total number of their respective nationalities, the Serbo-

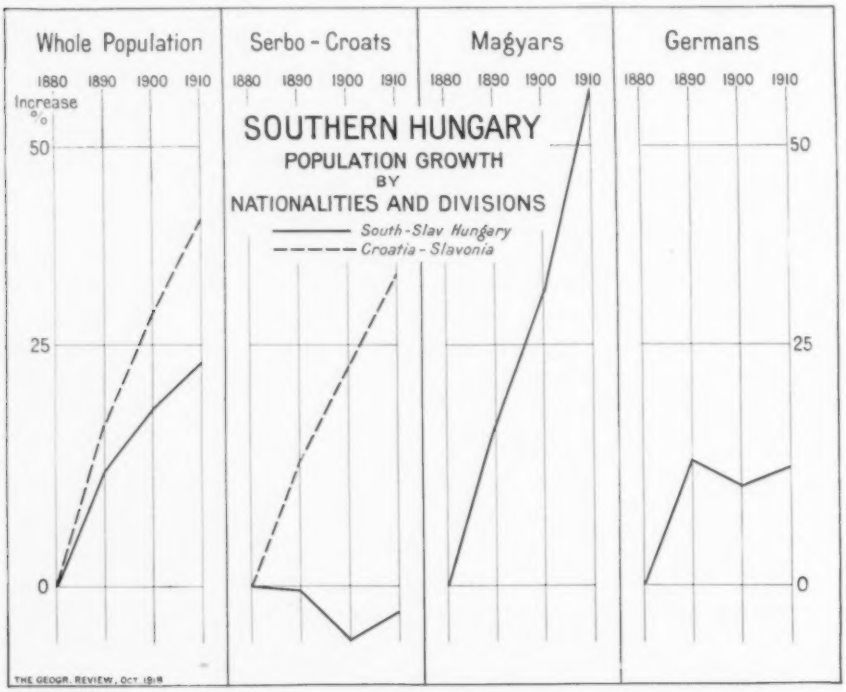


Fig. 1—Diagram showing, by nationalities and divisions, the population growth in southern Hungary from 1880 to 1910.

Croats of Hungary, 2,281,000 in number, are a minority of the total Yugo-Slav population of Central Europe. There are Slovenes and Serbo-Croats in Austria, so that Trieste like Fiume is an island on the edge of a Yugo-Slav sea. There are Serbo-Croats everywhere south of the Save both in Bosnia and Serbia. The total number of Yugo-Slavs may be estimated at 10,000,000, which number brings this people to the level of the Czecho-Slovak group of Northern Slavs and to half the magnitude of the Ruthenians, or Little Russians. Geographically the linguistic boundary of the Serbo-Croats is well defined on the northwest but is indeterminate on the northeast. Near the Austrian border the boundary lies along the Mur and the Drave; in fact, along this portion of the Drave occurs the most definite

linguistic boundary in Hungary. Passing eastward along the river, the moment the German element appears among the population the linguistic boundary leaves the river and becomes ill-defined. It runs across Baranya towards the confluence of the Maros with the Tisza and separates the Yugo-Slavs from the Magyars; farther east the line turns southwards across the Banat and separates the Slavs from the Rumanians.

There arises, however, one fact of considerable importance. The whole of the Save, the country along the right bank of the lower Drave, and the Danube for a large portion of its course eastward lie within Yugo-Slavia. This territory abuts on the Rumanian lands to the east, and the Slav populations on both sides of the Danube cut off a large portion of that river from the Magyar people and at the same time separate the navigation of the Magyar portion of the Danube from the navigation of the Magyar portion of the Tisza. This fact alone gives a considerable economic and political value to the solution of the problem of the future of the South Slavs and naturally gives greater prominence to that problem than to the problems of the Rumanians and the Slovaks. It must be noted, further, that the lands of the South Slavs are, on the whole, productive cultivable lowlands. South-Slav Hungary contains in the Bácska and western Banat the southern portion of the Alföld, with all its latent agricultural possibilities, for its present comparatively high state of cultivation is but an index to what the land might yield under different conditions in the future.[1] Here, again, is a factor which adds to the importance of the problem of the South Slavs.

Finally, it must be noted that Croatia-Slavonia is the one district in the Hungarian kingdom which is supposed to have an autonomous constitution. The country is under the rule of the Ban and has its own parliament, which sends representatives to the Hungarian parliament at Budapest. These are, however, limited in their voting to questions which affect Croatia-Slavonia. Like many other Hungarian institutions this arrangement is theoretically admirable, but in practice it suffers from the fact that the official in Hungary must be a Magyar. The Ban is removable at will by the Hungarian premier, and the parliamentary elections are conducted orally by a Magyar official, so that it is always possible to secure a Magyarist majority in the Croatian parliament. It is stated that for some months prior to the outbreak of war the whole of southern Hungary was under martial law.

Natural Increase of the Population

The birth rate in southern Hungary is, in general, high; the Serbs are the most prolific, their birth rate being equal to that of the Ruthenians. The Croats have proportionately as many births as the Slovaks. Both

[1] Cf. the article by the author: The Peoples of Hungary: Their Work on the Land, *Geogr. Rev.*, Vol. 4, 1917, pp. 465-481.

peoples have a higher birth rate than the Rumanians. The death rate of the Serbs is the highest in Hungary; the Croat death rate is approximately on a level with those of the Rumanians and the Slovaks. Consequently the natural increase of the Croats exceeds that of the Serbs and is as high as that of the Slovaks in Ruthenian Slovachia. The rates of natural increase

TABLE III—VITAL STATISTICS, 1900-1910

NATIONALITY	RATES PER 10,000 PER ANNUM			INFANT MORTALITY, PER CENT OF LIVING BIRTHS	ILLEGITIMATE BIRTHS, PER CENT OF TOTAL BIRTHS
	BIRTH	DEATH	NATURAL INCREASE		
South-Slav Hungary					
Magyars	373	264	109	22	8
Germans	378	228	150	23	8
Serbs	413	326	87	27	15
Croatia-Slavonia					
Croats	392	244	148	17	4
Serbs	463	330	133	22	8

of Magyars and Germans in South-Slav Hungary are very different from the corresponding rates in the Rumanian Forelands; the Germans in Baranya and the Bácska have a greater natural increase than the Germans in any other part of Hungary, while the Magyar rate in the same area is almost as low as the Magyar rate in Transylvania.

The rate of infant mortality in Croatia-Slavonia resembles those in Ruthenia and the Rumanian Forelands, but the rates in South-Slav Hungary are the highest in the kingdom. The Serb rate is excessive; one child out of four who are born alive dies before it attains its first birthday. The rate among the Germans indicates the effect of the birth rate (which is high for Germans) and confirms the difference already noted between the Swabians in South-Slav Hungary and the Saxons of Transylvania. The Serb proportion of illegitimate births is exceeded in Hungary only among the Magyars of the Rumanian Forelands; the Roman Catholic Croats, like the Roman Catholic Slovaks, have a small proportion of illegitimate children.

As was the case among the Northern Slavs the curves of change of population (Fig. 1) indicate chiefly the results of migratory movements of the people, for the least prolific race shows a steady and continuous increase in numbers. This is the case even in Croatia-Slavonia, since the curve for Serbo-Croats is less steep than the curve for total population, although the Serbo-Croats are on the whole increasing most rapidly from natural causes.

MIGRATORY MOVEMENTS

Emigration from South-Slav Hungary was about 60 per cent of the natural increase of the population. More than half of the emigrants were Germans, although the Germans number less than one-third of the population. The Serbs and Magyars each provided approximately one-tenth

of the emigrant stream, where the Serbs form a fifth and the Magyars nearly a third of the population. The Germans, therefore, are losing ground in South-Slav Hungary like the Slovaks in Ruthenian Slovachia. In Croatia-Slavonia the Germans provided 7 per cent of the emigrants from 5 per cent of the people. The total emigration from this area was about a third of the natural increase, and the Serbo-Croats provided a proportion of the emigrants equivalent to the strength of their element in the population.

TABLE IV—ESTIMATED NET EMIGRATION, 1900-1910
(*Percentages of total*)

	(A) NATIONALITIES			
	MAGYARS	GERMANS	CROATS	SERBS
From:				
South-Slav Hungary	10	58	..	11
Croatia-Slavonia	3	7	58	28
	(B) DESTINATIONS			
From:	To: Germany	Balkan States	Rest of Europe	America
South-Slav Hungary	4	..	1	90
Croatia-Slavonia	2	5	6	84

More than five-sixths of the emigrants went to America, a proportion which exceeds that from the Rumanian Forelands but fails to reach the magnitude of the emigration to America from the lands of the Northern

FIG. 2—Cartogram of southern Hungary showing the movement of the population. Scale, 1:5,100,000. For the names of the counties indicated by hair-line numerals see the key below. The counties are grouped to form two large divisions for the purposes of this article, Croatia-Slavonia and South-Slav Hungary. The statistics in the tables and elsewhere in the text relating to these two divisions are based on the constituent counties as here shown.

Key to Counties: 1, Lika-Krbava; 2, Modrus-Fiume; 3, Zágráb; 4, Varasd; 5, Belovár Körös; 6, Pozsega; 7, Verőcze; 8, Szerém; 9, Baranya; 10, Bács-Bodrog; 11, Torontál; 12, Temes.

Slavs. Although Croatia-Slavonia is only separated from Serbia by rivers as a natural obstacle, while Transylvania is separated from Rumania by mountains, comparatively few emigrants left Hungary for Serbia. The proportion of emigrants to Germany lies intermediate between that from

the Northern Slav lands and that from the Rumanian lands. The net balance of internal migration amounts to a small inflow of people into each of the areas; the details of the movements are summarized in Figure 2. Two of the South-Slav counties received an inflow of Magyars, which was balanced in part by an outflow of Croatians from Baranya. Within Croatia-Slavonia the Croats tended to move eastward; there was an inflow of Slovaks into eastern Slavonia and an outflow of Croats and Germans from Croatia. The excessive emigration of Germans from South-Slav Hungary tends to account for the variations in the slope of the German curve in Figure 1.

Religions

Table V indicates the sharp religious cleavage which is practically the only distinction between the Serbs and the Croats. The Serb is a member of the Greek Orthodox Church while the Croat is a Roman Catholic; this separation implies that the Croats, with the Magyars and the Northern Slavs of Hungary as well as the majority of the people of Austria, are under the spiritual authority of the Roman Pope; it means also that the Croats and Slovenes have the same religion, while the Serbs belong to the same church as the majority of the Rumanians. The distinction is, therefore, largely geographical. The few Jews of southern Hungary are chiefly German Jews. The Germans of southern Hungary are mainly Roman Catholics while the Germans of Transylvania are nearly all Lutherans. This fact adds point to the distinction commonly current in Hungary between the southern Swabian and the eastern Saxon. The Magyars, as

Table V—Religious Adherence
(*Percentages of total for each nationality*)

Nationality	Roman Catholic	Calvinist	Lutheran	Greek Orthodox	Jew	Others
South-Slav Hungary						
Magyars	79	18	..	1	1	1
Germans	71	..	17	..	11	1
Serbs	3	..	..	96	..	1
Croatia-Slavonia						
Croats	97	..	..	1	..	1
Serbs	3	..	..	94	..	3

elsewhere, are either Roman Catholics or Calvinists; the proportion of Roman Catholics is higher than that which obtains in Slovachia. It is noteworthy that in the east, where the linguistic boundary is not marked by distinct physical features, differences in religious outlook tend to outweigh the disadvantage, except where Serb marches with Rumanian in the Banat.

Elementary Education

In educational matters as in other affairs South-Slav Hungary is similar to Slovachia, and Croatia-Slavonia resembles Ruthenia and Transylvania.

In South-Slav Hungary a high proportion of the children are on the registers of the schools, two-thirds of which are Church institutions. Magyar is the language of instruction of two-thirds of the schools, while the Magyars form but half of the population; the Serbo-Croats have as many schools as they are entitled to in proportion to their numbers; but the Germans have few schools, only one in twenty-five, while they form more than a quarter of the people. The Rumanian element in the western Banat has schools in proportion to its numerical strength.

TABLE VI—ELEMENTARY EDUCATION, 1910

DIVISION	PERCENTAGE OF TOTAL NUMBER OF CHILDREN BETWEEN 6 AND 14 NOT ON THE SCHOOL REGISTERS	PERCENTAGE OF THE UNREGISTERED WHO ARE OFFICIALLY EXCUSED FROM SCHOOL ATTENDANCE	PERCENTAGE OF THE SCHOOLS			
			(i) WHICH ARE:		(ii) WHERE THE LANGUAGE OF INSTRUCTION IS:	
			STATE OR COMMUNAL	CHURCH	MAGYAR	NON-MAGYAR
South-Slav Hungary	8	22	32	66	67	33*
Croatia-Slavonia	33	‡	92†	3	4	96§
Magyaria	12	21	35	62	99	1
Hungary proper	12	29	25	74	78	22‖

* 17 per cent Croat or Serb, 11 per cent Rumanian, 4 per cent German. † All communal. ‡ Not stated.
§ 96 per cent Croat or Serb. ‖ 14 per cent Rumanian, 3 per cent German, 3 per cent Slovak.

In Croatia-Slavonia the Magyars form 4 per cent of the population and have 4 per cent of the schools; all the other schools are Serbo-Croat, so that German and Slovak children cannot receive instruction in their own tongue. One child in three escapes school attendance and nine schools out of ten are communal institutions. Croatia-Slavonia is allowed to develop its own educational system, while the Magyars receive preferential treatment educationally in South-Slav Hungary.

Table VI indicates considerable similarity in educational conditions between South-Slav Hungary and Magyaria, so that it might be expected that the standard of education was approximately the same in both areas; yet in Table IX it is shown that half the Serbs are illiterate, while only a quarter of the Magyars and a sixth of the Germans are unable to read and write. These values give roughly a quarter of the population as illiterate, which is the same proportion as obtains in Magyaria. Can it be said that the Serb is less susceptible of education than the Magyar, or is it due to the alleged indifference of the Eastern Church to education? May it not be, on the other hand, an effect of an administrative policy common to the whole of the Slav lands, both north and south? The Slovaks have been oppressed; have the Serbs experienced a like fate?

PUBLIC HEALTH

The medical service in Croatia-Slavonia is inadequate to the population. Out of six people who die in that region five are Serbo-Croats, and four of them neither receive medical treatment during illness nor is their death

certified by a physician (Table VII). In Hungary proper there is one physician on the average for 3,500 people; in Croatia-Slavonia the average is one physician for 6,800 (Table VIII). The proportion of pharmacies and midwives to population shows that the public health service in Croatia-Slavonia is less adequate than among the mountainous tracts of Ruthenia

TABLE VII—PUBLIC HEALTH, 1901-1910

NATIONALITY	PERCENTAGE OF DEATHS		CAUSES OF DEATH (PERCENTAGE)				NOT CLASSIFIED
	NOT TREATED BY A PHYSICIAN	NOT CERTIFIED	TUBERCULOUS DISEASES	PNEUMONIA OR PLEURISY	CONGENITAL DEBILITY	SENILE DEBILITY	
South-Slav Hungary							
Magyars	56	51	15	9	8	17	21
Germans	41	37	12	10	11	10	23
Serbs	68	63	16	9	18	13	14
Croatia-Slavonia							
Croats	76	90	15	7	14	12	20
Serbs	90	96	15	4	20	9	24

and Transylvania. Tuberculosis appears to be more rampant than in Transylvania, and the heavy rate of infant mortality among the Serbs is connected with the high death rate from congenital debility. It might, perhaps, be suggested that since there is a certain amount of local autonomy in Croatia-Slavonia, where a considerable portion of the budget is earmarked for expenditure in the country itself, the responsibility for the defects in the medical and public health services rests upon the Serbo-Croats and not upon the Magyars; but it must be remembered that the election and other arrangements throw the whole of the machinery of administration into the hands of Magyars, who must accept responsibility for affairs in Croatia-Slavonia as elsewhere in Hungary. The Serbs in Hungary proper receive better medical treatment, since public health officers are more numerous in South-Slav Hungary than in Slovachia or the

TABLE VIII—PUBLIC HEALTH SERVICE, 1910

DIVISION	NUMBER OF PEOPLE PER:			NUMBER OF FEMALES PER MIDWIFE
	PHYSICIAN	PHARMACY	HOSPITAL BED	
South-Slav Hungary	4,100	6,400	625	700
Croatia-Slavonia	6,800	13,300	480	1,400
Hungary proper	3,500	8,600	490	700

Rumanian Forelands. There are, however, more deaths among them from pleurisy or pneumonia than in Croatia-Slavonia. The Magyars and Germans receive better medical service than the Slavs, this preferential treatment being a common feature in all the lands where Magyars and Germans live with one or other of the "subject races."

ECONOMIC CONDITIONS

The Croats, like the Ruthenians and Slovaks, have a high disproportion of women to men. In Croatia-Slavonia there is a lower proportion of

adults at the working ages between 15 and 60 than in Transylvania, Ruthenia, or Slovachia. On the other hand the proportion of workers among the Serbs and Germans of South-Slav Hungary is the highest in

TABLE IX—ECONOMIC CONDITIONS
(*Rural Communities*)

NATIONALITY	NUMBER OF WOMEN PER 1,000 MEN	AGE GROUPS (PERCENTAGE)				PERCENTAGE OF POPULATION OVER 6 YEARS OF AGE ILLITERATE	HOUSES (PERCENTAGE)			PEOPLE PER HOUSE
		0-6	6-14	15-60	OVER 60		STONE OR BRICK	TIMBER	WITH THATCHED ROOFS	
South-Slav Hungary										
Magyars	980	17	21	53	9	27	4	4	42	4.9
Germans	1,007	15	20	57	8	15	10	..	26	4.7
Serbs	1,011	16	19	57	8	50	21	..	33	4.9
Croatia-Slavonia										
Croats	1,110	17	22	52	9	50	36	63	39	5.5
Serbs	1,035	17	23	53	7	60	16	42	20	5.9

Hungary; it is equaled only among the Rumanians of the Rumanian Forelands.

The Croats and Serbs are more illiterate than the Slovaks but less illiterate than the Ruthenians and Rumanians. The Germans, as usual, are the most highly educated people. In relation to the effect of the churches upon education it may be noted that the order of ability to read and write is as follows: Roman Catholic Slovaks, Roman Catholic Croats, Greek Orthodox Serbs, Greek Orthodox or Uniate Rumanians, Uniate Ruthenians.

Throughout both areas the character of the house material depends upon the locality, although there is the usual difference between a trim and tidy German village and one inhabited by other people. Among the dwellers on the Alföld the houses are made of dried clay with thatched roofs; among the timbered hills of Croatia wood is more freely used. In Croatia-Slavonia the average number of people per house is higher by one than the average for South-Slav Hungary; the number is equaled only among the Magyars in northern Hungary.

RAILWAY TRANSPORTATION

In proportion to its area Croatia-Slavonia has few miles of railway, although in proportion to population the service equals the average for

TABLE X—RAILWAY TRANSPORTATION

DIVISION	MILEAGE	
	PER 100,000 INHABITANTS	PER 100 SQUARE MILES
South-Slav Hungary	78	14
Croatia-Slavonia	51	8
Magyaria	50	13
Hungary proper	71	10

Hungary proper. South-Slav Hungary has the best railway service in the country, since it is crossed by the international route to Constantinople

from Paris, as well as by the lines for the Transylvanian plateau; yet even here the railways are not designed to serve local interests.

Northern and Southern Slavs

Slovaks and Serbo-Croats are peasant peoples tied by tradition and training to tillage of the ground. The Slovaks in their northern home are the people of the potato; the Serbs, with their infiltration of Mediterranean culture, are the people of the plum tree. The Slovaks are oppressed by the Magyar bureaucracy; the Serbo-Croats have a nominal measure of autonomy, based upon a local parliament (usually packed to give it a Magyarist majority) under the rule of a local governor, who is removable at will by the head of the Hungarian government. The Slovaks have neither a local parliament, nor are they represented in the Hungarian parliament by a Slovak party. The Northern Slavs are separated from the Southern Slavs by the Magyars and Germans, who occupy central Hungary. Near the western border of Hungary Croats have occupied the small mesopotamian area between the Mur and the Drave; the Slovenes in Hungary, a kindred people to the Croats, hold a small area north of the Mur, and a few Croats live in scattered islands between the Slovenes and the Danube near Pozsony. In the boundary zone between the Magyars and the Rumanians on the east of central Hungary there are islands of Slovaks, which even extend into eastern Slavonia; but neither the scattered islands of Croats on the west nor the less numerous islands of Slovaks on the east serve to provide a connecting link between the two main groups of Hungarian Slavs: the islanders must remain islanders isolated from their kinsmen or migrate from their present homes. The Slovaks can only look to the Czechs of Bohemia for leadership and assistance; they have Ruthenians on their eastern margin. Similarly it would appear that the Yugo-Slavs of southern Hungary are driven to look to Serbia for leadership and to the Western Powers, pledged as they are to the reconstitution of Serbia, for assistance; they have Rumanians on their eastern edge.

The Northern Slavs meet resistance from Germans along their western and northwestern boundaries; the Southern Slavs find considerable opposition from a section of the Italian people in reference to the Slav boundaries on the west and southwest, along the Adriatic. The Northern Slavs are adjacent to the storm center of Poland, whose historical vicissitudes have fastened public attention on their woes rather than on the troubles of the Slovaks; but the future of the Slovaks must be affected by the solution of the Polish problem, and their prosperity will, to some degree, depend upon the economic development of the Polish mines and industries. The Southern Slavs are adjacent to the storm center of the Balkans, and their continuance as a race depends upon the satisfactory outworking of plans under which the Balkan peoples can settle down harmoniously to the development of the latent possibilities of their land.

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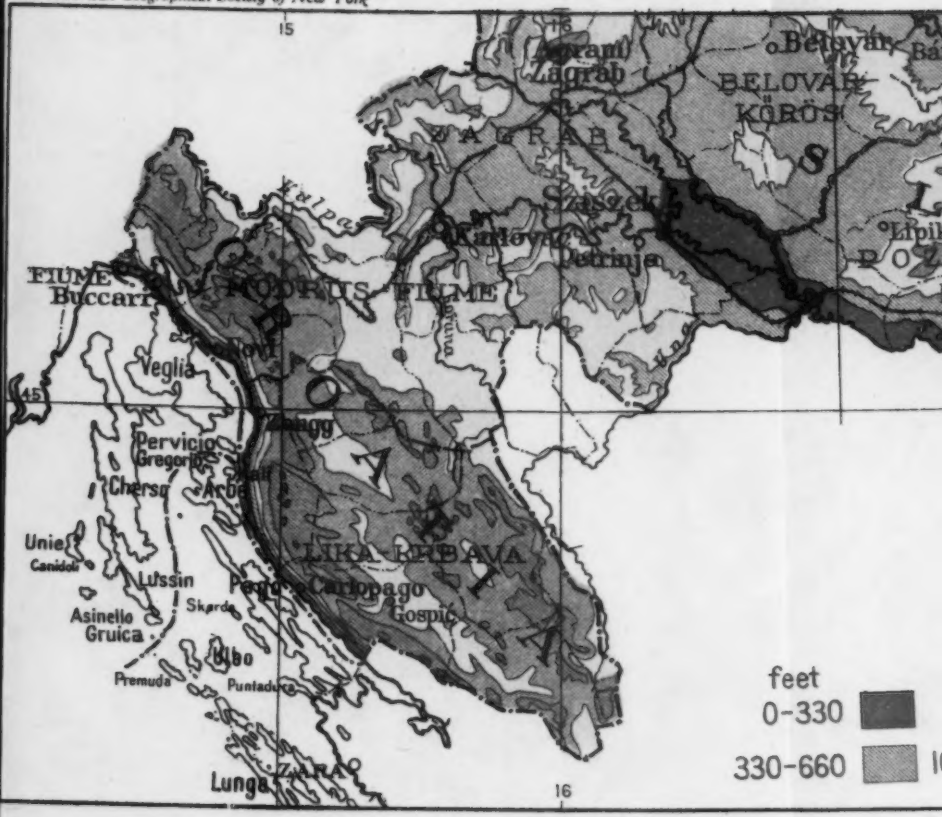

SOUTHERN HUNGARY

Scale 1:2000000

0 10 20 30 40 50 miles

Geographical Data Compiled by B.C. Wallis

Boundaries: —•—•— National, —·—·— County, —··—··— District and Muncipality

RELIEF

meters	feet	meters	feet	meters
0-100	600-2000	200-600	3300-5300	1000-1600
100-200	2000-3300	600-1000	over 5300	over 1600

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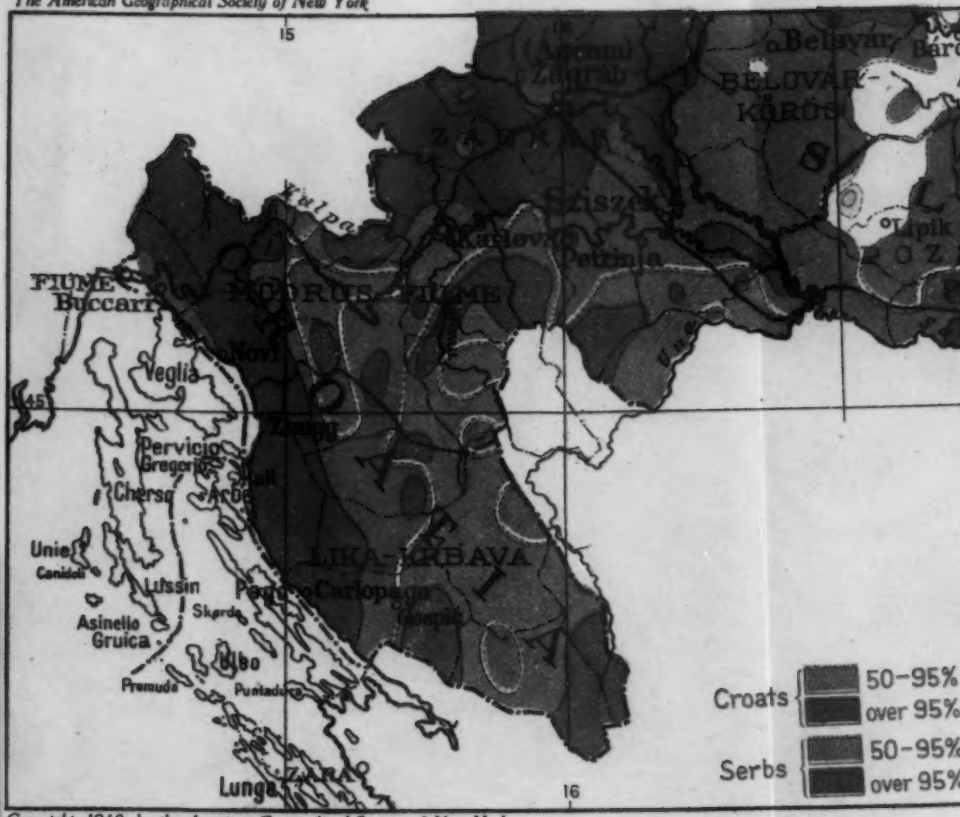

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SOUTHERN HUNGARY

Scale 1:2000000

0 10 20 30 40 50 miles

Geographical Data Compiled by B.C.Wallis

Boundaries: —·—·— National, —·—·— County, ——— District and Municipality

NATIONALITIES

Magyars	50-95%	Slovaks	50-95%	Rumanians	50-95%
	over 95%				over 95%
Germans	50-95%	Ruthenians	50-95%		
	over 95%		over 95%		

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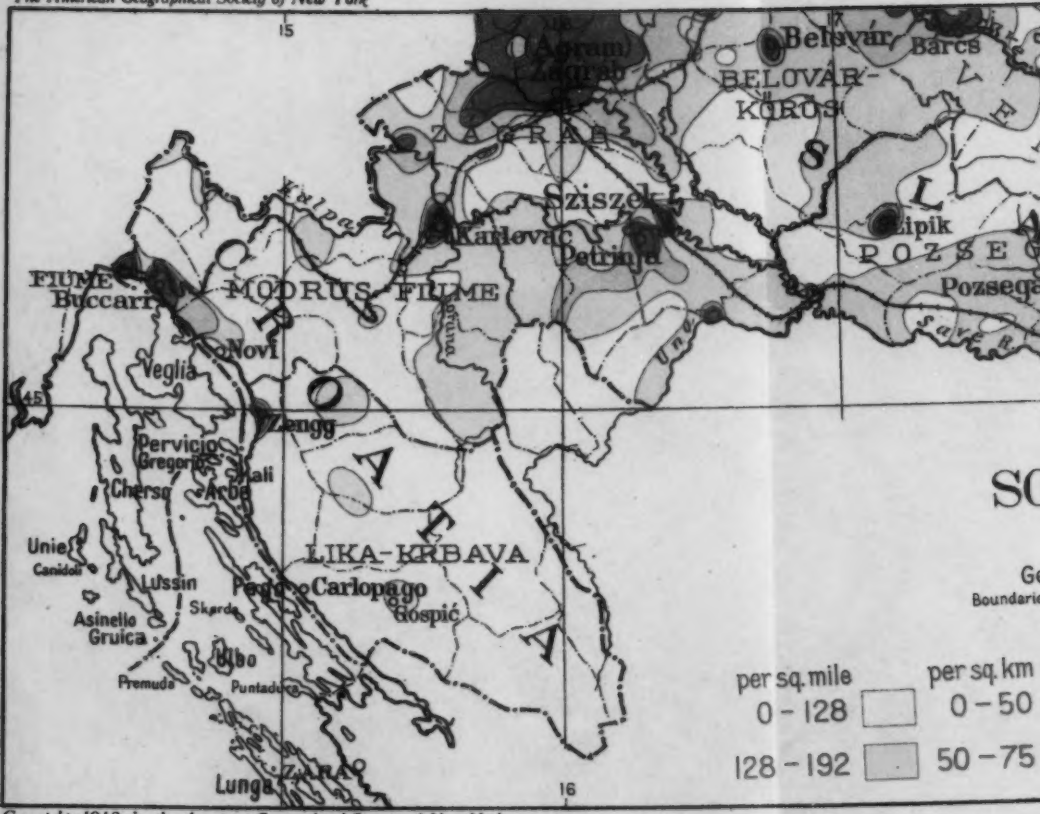

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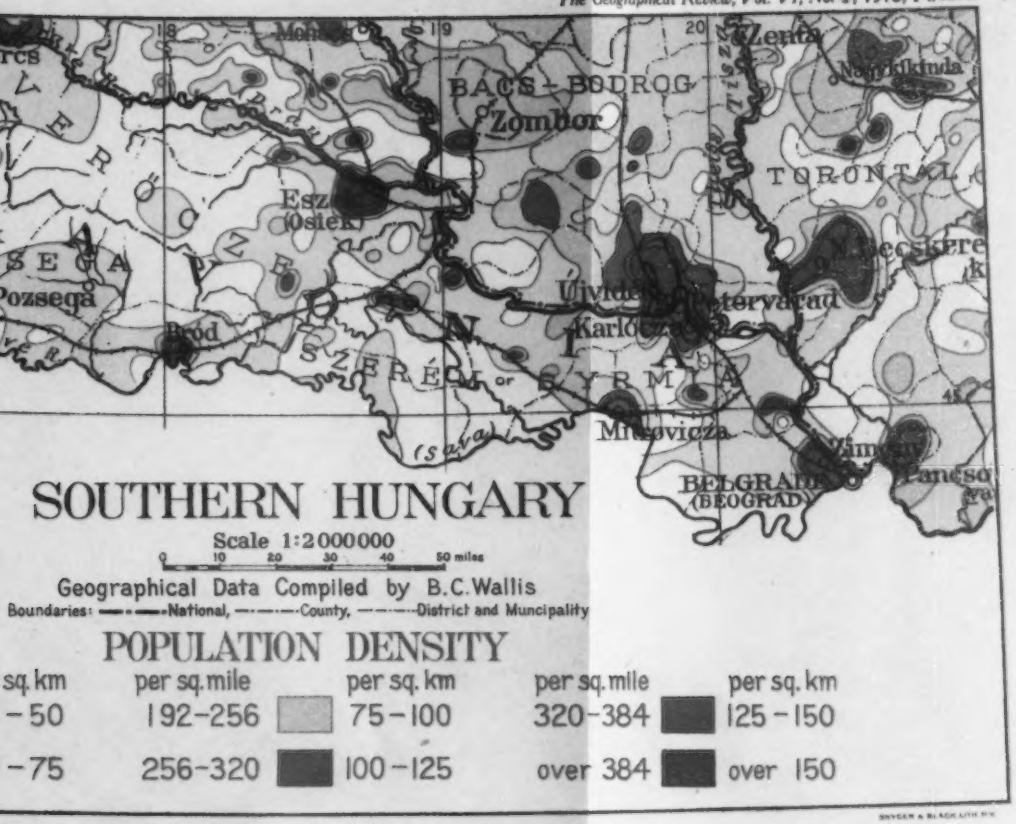

SOUTHERN HUNGARY

Scale 1:2000000

0 10 20 30 40 50 miles

Geographical Data Compiled by B.C.Wallis

Boundaries: —·—·—National, —·—·—County, — — —District and Muncipality

POPULATION DENSITY

sq. km	per sq. mile		per sq. km	per sq. mile		per sq. km
-50	192-256		75-100	320-384		125-150
-75	256-320		100-125	over 384		over 150

The problems of the Slovaks and the Croats, consequently, tend to be overshadowed by the apparently more insistent problems of their neighbors, whose troubles have awakened the sympathies of all civilized peoples; yet two facts must not be forgotten. First, the Northern and Southern Slavs are two horns where the Slav peoples reach farthest west; they hold two important geographical lines of communication. The Northern Slavs are the western end of that band of their race which occupies the densely peopled east-and-west route along the edge of the Northern Carpathians, penetrates the Moravian Gate, and holds the Bohemian Plateau. The Southern Slavs hold the western end of the great Danube route from the Black Sea to the Adriatic; they occupy the basin of the Save and the coast lands where the easiest routes approach the Adriatic Sea. Between these two horns the Germans are continuous from South Germany through central Austria almost to Budapest; east of the Germans lies the Magyar block. Secondly, the route from Berlin to Constantinople is crossed by both groups of Slavs; and, should Austria-Hungary persist either as an empire or as a federation, so long as Prussia dominates her politics the Prussian can claim that he has won the war, for he will have succeeded in his primary aim, the establishment of Prussian authority over Central Europe and of economic slavery to Prussia therein.

THE ACTIVITIES OF THE CANADIAN ARCTIC EXPEDITION FROM OCTOBER, 1916, TO APRIL, 1918*

By VILHJÁLMUR STEFÁNSSON

[With separate map, Pl. XVIa, facing p. 368.]

The *Polar Bear*, one of the vessels of the Northern Division of the Canadian Arctic Expedition, wintered in 1915-1916, it will be remembered, half way up Prince of Wales Straits, between Victoria and Banks Islands. It was correctly reported by Dr. Anderson, Mr. Wilkins, and other members of our expedition on their return south in 1916, that my intention was to have the *Polar Bear* return home by Melville Island and thence by the well-sailed eastern route to the St. Lawrence. As will appear later, this was never attempted.

While it had not occurred to me that the *Polar Bear* might fail to attempt coming, I fortunately realized clearly enough that one thing or another might frustrate the best-meant attempt. We should then not only have to winter in Melville Island on the native resources of that country; but, if we did not want to waste also that part of the following spring which precedes navigation, we should have to get ready to do the work of 1917 on meat only, or at least mainly. True, I knew of the large food caches left on the south coast of Melville Island by former explorers, but I was so much impressed with the danger of scurvy and with the anti-scorbutic value of fresh meat that I should have been more at ease in my mind had I not known those caches were there. In my experience men are healthy and contented when they know that all foods but meat are out of the question, but healthy and discontented if they know of other things they might be eating if they were only allowed. In order, then, to provide fresh meat against the dark period of winter and dried meat and fat for food and fuel on the ice trip of 1917, I asked Storkersen with eight Eskimos to spend the summer of 1916 in Melville Island putting up meat. It proved that they dried for sled rations the meat of over ninety muskoxen and thirty seals, with several bears and a few reindeer; in the

* The following account was sent to the *Geographical Review* by Stefánsson from St. Stephen's Hospital, Fort Yukon, Alaska, under date of June 17, 1918. It was written by the author as a continuation of the narrative of his activities published in the March *Review* (Vol. 5, 1918, pp. 238-241), which he had just read, and carries the record from October, 1916, to the spring of 1918, when he was rapidly convalescing from the attack of typhoid with which he had been stricken in the Mackenzie delta the January before. The important advance into the polar sea from the first newly discovered island, briefly mentioned in the *Review* note on the basis of the meager newspaper accounts of the time, is, among other matters, here dealt with fully. Because of his illness the author was unable to bring with him any of the expedition records; he, therefore, wishes to state that dates and geographical positions cannot be relied on to be more than approximately correct.

The map which accompanied the note in the March *Review* is republished with the present article (Pl. XVIa), revised and amplified to bring it up to date.—EDIT. NOTE.

latter part of summer they killed for clothes and meat over sixty reindeer and about half a hundred additional muskoxen. More could easily have been killed, but this was considered enough.

Winter Quarters on Melville Island

During the winter of 1916-1917 we maintained two camps on Melville Island. The southern, with Storkersen in charge, was on the Dundas Peninsula side of Liddon Gulf about 15 miles northeast of Cape James Ross and a mile inland; the northern, an advance base in charge of Aarnaut Castel, was on the coast just west of Cape Grassy, Hecla and Griper Bay. The location of both camps was determined by the finding of bituminous coal; at Cape Grassy only, however, was the supply good in quality, abundant, and of easy access. At Cape Grassy mineral oil, or asphalt, was also found.

The chief business of the winter was sledding dried meat and fat from Liddon Gulf, where the animals were killed, to Cape Grassy, about 150 traveling miles from the southern camp. But because of the non-arrival of the *Polar Bear* we were seriously handicapped in the dark-days travel by lack of lanterns and kerosene both for light and cooking. Instead we had to use seal oil and coal, neither of which is convenient in comparison with kerosene or alcohol. The shoeing of our sleds was also nearly worn out, for Melville Island is prevailingly rocky; indeed, for wearing down runners the whole place might almost as well be paved with files and grindstones as with its native jagged, frost-broken rock. We did not positively remember, any of us, whether Bernier had made a cache at Winter Harbor in 1910, but for the sake of possible iron and kerosene we sent a sled there in October. We intended it should go to Dealy Island as well, for some of our men unfortunately had developed a taste for tobacco out of proportion to our resources, and it was supposed tobacco was to be had at Dealy Island. The team never went beyond Winter Harbor, however, for Bernier's cache there was found to contain, besides the iron shoeing for sleds and the kerosene (50 gallons) that were priceless to us, also several tons of foods such as pemmican (salty), beef extract (half of it rock salt), pilot bread, flour, pork, honey, preserved fruit, and in general the very assortment of foods which, while it does not invariably produce scurvy, is yet the common prelude to it. I had previously hoped that the Dealy Island cache might have its food all spoiled; this hope was now unavailing, for the Bernier cache contained several tons. The temper of our men was such that I did not try the experiment of keeping them on meat straight, but merely cautioned them to eat fresh meat at most or all meals. Neither did I allow more than a limited number of packages to be opened at either of our permanent camps, but on those sled trips where I was not myself present the amount of groceries consumed was at the men's discretion. I mention this here because it has a bearing on a serious thing that happened later.

Arrival of "Polar Bear" Party

The winter of 1916-1917 we fed in Melville Island seventeen persons and over forty dogs. By February most of the dried meat and fat had been collected at the Cape Grassy advance base or else been eaten up by men or dogs. On the last freighting trip there the dogs unfortunately lost much flesh through a miscalculation of the dog feed for the last return journey, and we lost ten days or so by waiting till they were in flesh again. By this time we had concluded that the *Polar Bear* had probably been wrecked the preceding summer, for had she remained where she had previously wintered a party from her should have arrived long before this. We were surprised, therefore, when a party from her actually arrived the last of February and astounded when we learned that she had suffered no damage but had sailed a hundred miles farther away from us instead of coming north and was now wintering at Collinson's old base, Walker Bay, Victoria Island. The details which led to that proceeding are too many and complicated to be related here. The main thing just now was that this party from her brought us five men and over twenty dogs but no dog feed and not nearly enough man food to provision the extra men as well as we were already provisioned, per capita. I made here a serious mistake. I should either have left these men and dogs in Melville Island or sent them right back to the *Polar Bear*, for, when we later ran out of food, it proved we lost more time at a critical stage in the hunting of fresh meat than we gained by the service of the fresh men and dogs. Had we had only our original sleds we could have left the Cape Grassy base with all teams hauling dried meat and fat only; as it was, three of our seven sleds had to haul green meat, which is heavy and inconvenient to handle when it is hard as a rock from frost. The *Polar Bear* party had brought us Primus stoves and additional kerosene. Those things added greatly to our comfort, though they did not tend proportionally, if at all, to increase our mileage.

Advance North of First Island

It was past the middle of March when the last sleds left the Cape Grassy camp, and by the first of April we had completed the survey (roughly) of what remained yet to do of our First Island to Cape Mamen and a few miles beyond (to the northwest).

It was now time to send back our first support party. I had wanted Karsten Andersen to be one of the advance party, but he now told me that he had been ill for some two weeks and was feeling more sluggish and weaker each day. On examination he proved to have symptoms of scurvy, but as I then thought he had been living all winter mainly on fresh meat I took his ailment to be pyorrhoea, together with some constitutional disorder. The first week of April from a point about 50 miles from land and 30 from the shore floe I sent back the support party, instructing Storkersen to take most of our people from Melville Island to the *Polar Bear*. Castel, accom-

panied by Andersen and four Eskimos, I instructed to proceed to the Cape Kellett base by way of the Bay of Mercy, Cape McClure, and Prince Alfred Cape, searching on the way for a party who, our men from the *Polar Bear* told us, had gone from Cape Kellett with mail for us in the early winter. No such party had reached us in Melville Island, and we feared misfortune had overtaken them.

Storkersen's Survey of Victoria Island Coast

Storkersen also had instructions to make up a party on his arrival at the *Polar Bear* and try to reach Amundsen's (Hansen's) farthest on the northeastern coast of Victoria Island. Although out of its chronological order, I shall say here that, through a slip, he made this journey without a map or other record of the mathematical position of Cape Nansen (Hansen's farthest) and that he did not know at the time of his turning back from the survey trip that his turning point was a few miles short of Cape Nansen. An additional reason for his turning back was the discovery of an island apparently considerably more than twenty miles in length lying north of the northeastern corner of Victoria Island. It appears that Hansen and Ristvedt just missed seeing this island. The coast line of Victoria Island is therefore now completed beyond the probability of the future discovery of any conspicuous geographic feature not already indicated either by Hansen or Storkersen. The land east of Wynniatt's farthest (Glenelg Bay) proves to run well to the north, thus forming a great bay having its western limit at Peel Point. This I have called Wynniatt Bay, and the strait separating Victoria Island from the new island to the northeast is Hansen Strait. A range of fine mountains lying roughly parallel to the northern coast of Victoria Island I have named Shaler Mountains.

On his way back Storkersen was compelled by the advancing thaws to abandon his sleds in Collinson Inlet and to cross Victoria Island thence to Walker Bay. This crossing had its own interest and had been recommended by me should time not allow a crossing from Hansen's farthest, which would obviously have been preferable. His party arrived at the *Polar Bear* about the end of July.

Ice Conditions in the Polar Sea

To resume the narrative of our own movements: At the shore floe we killed some seals, but in general game was not abundant, comparatively, on or in the sea north of First Island.

The journey north-northwest from Cape Mamen was of special interest to us, as the ice conditions were so markedly different from any we had seen before. In other years the ice had been of the mobile type described by Baron Wrangell and by Leffingwell and Mikkelsen, where no sane man would leave a cache expecting to pick it up on the return journey. But on the ice north of First Island a cache, if made, could probably be found.

When we eventually turned back we did not try to follow our old trail, though it is more than likely we could have done so. We learned nothing of the mobility of the ice under the influence of a north wind, for unfortunately none such blew while we were at sea, and such a wind may be capable of producing considerable motion in the ice; but a series of strong easterly and southerly winds produced a westing and a northing of about three miles only. This could all have been accounted for by the widening of the First Island and Isachsen Land shore lead, for that lead we have seen open four or five miles at right angles with the trend of the shore floe—i. e. northwest. This we noted in our journey along that lead in 1916. The same winds that gave us three miles of motion near 80° N. and 111° W. would have given thirty to fifty miles in the Beaufort Sea south of 74° N.

More than 90 per cent of the ice seen in 1917 north of First Island was either of the type termed paleocrystic or pressure ridges made of the younger ice that had formed in temporary leads and was now crushed into pressure ridges. There was terrific pressure both with and without local winds, but the great thickness of the paleocrystic ice (doubtless averaging over twenty feet) prevented its ridging extensively, though it cracked in all directions.

Submarine Relief

But perhaps the most striking thing observed was the character of the sea bottom. At the shore floe some fifteen miles from land the depth was 468 meters; ten or fifteen miles farther from shore it was 456 meters and ten miles farther still it was 444 meters. Then it started deepening till we had 570 meters about seventy-five miles from land, after which it gradually shoaled again to 502 meters at our farthest, which was near 80½° N. and 111° W. Later in the summer, when we ran a line of soundings across Melville Sound from Cape Providence to Peel Point and then to Point John Russell, we found the depth of that sound to be generally about 450 meters and that it deepened and shoaled irregularly much as our sounded area does northwest of First Island. Going north from Alaska the sea deepens roughly a fathom to the mile till about forty miles from shore, after which there is a steep slope to a depth of 1,386 meters with no bottom reached. The slope is more gradual west of northern Banks Island and west of southern Prince Patrick Island, but still in both those regions it goes below 1,000 meters in less than fifty miles from shore. In the region of First Island the deepening is 34 meters only in over a hundred miles of increased distance from land. On the west coast of First Island we found a depth of 70 meters in 1916 less than a quarter of a mile from shore and 250 meters three miles from shore, if I remember rightly. In that same sudden way does Melville Sound deepen away from Melville Island and Banks Island. In the summary of our work in the *Review* (March, 1918, p. 241) the view is advanced that it would seem that "no land exists west of the known limit of the American Arctic Archipelago." It seems to me

that that conclusion would have been much more strongly supported had we found a deep ocean northwest of our First Island and of Isachsen Land. But instead of a deep ocean we found a shallow sea which did not deepen materially as we left the known lands behind. In this connection the soundings of MacMillan northwest of Cape Thomas Hubbard would interest me greatly, but I have not yet heard what they were.

Tidal Observations

With reference to the theory by which Harris and others have inferred a land to the north of Alaska, our tide observations should prove of interest. We took ten-minute observations for more than twenty-four hours in each of the following places: Cape Isachsen, Hassel Sound, and the southern end of Third Island. All these have local time, determined instrumentally on the spot, and, as will appear later, the sounding places are "tied up" with Parry's observation spot at Winter Harbor. We also had tide observations taken for a month at Cape Kellett and for most of a winter in Prince of Wales Straits.

Return to Land with Scurvy-Stricken Men

I think it was in the last third of April that two of my three companions began to complain of illness. The men I had were Harold Noice and A. L. Knight, both from Seattle, and the Eskimo Emiu of Nome, Alaska, where he has a reputation (under the name of Split-the-Wind) as a long-distance runner. The sick men were the two whites, and their symptoms were those of scurvy. It was only now that I learned that they (as well as Karsten Andersen, already sent home sick) had been living half the winter mainly on the groceries of the Bernier cache. I was worried at this time also about my remaining companion, Emiu, for he, too, had lived much of the winter, I now learned, on groceries also. He was not stricken, however, perhaps because he had the last few weeks eaten a good deal of raw fresh meat, probably the best of all anti-scorbutics. The white men, not at that time realizing their imminent illness, had eaten little meat and none of it raw.

It was an uncomfortable situation to have two men out of four taken seriously ill over a hundred miles from land. Their disinclination to eating meat disappeared magically when they were confronted with scurvy and its associated dangers, but it happened that we had just finished feeding to the dogs the last seal meat shot some days before and were in a region where seals could not be expected to be numerous. Naturally they are to be found only in leads that run partly through ice formed not later than the preceding autumn, and now we were in an area almost exclusively paleocrystic. We, therefore, turned at once towards the nearest land, Cape Isachsen. I knew that should the shore lead there be open we could get seals and should it be closed we could proceed inland looking for reindeer. The advance of the scurvy seemed temporarily checked by eliminating pem-

mican and salt from the sick men's diet and substituting cereals and chocolate.

A gale at this period broke up the ice badly, and, as the weather was no longer cold enough, the leads refused to freeze over quickly, and we had to make numerous expensive detours to find crossing places. Before we were half way ashore the advance of the disease had compelled Noice to ride whenever the going was good, and the last few days he rode always, except when crossing actual pressure ridges or dangerous spots over thin ice. Knight was able to walk all the way to shore, and both men showed excellent spirit in being as useful as their rapidly lessening strength and increasing distress allowed. Emiu, the Eskimo boy, was excellent.

It was about the first of May that we landed south of Cape Isachsen, for the lead was not open at the edge of the landfast ice and stormy and cloudy weather prevented seals from basking on the ice. The first day of our following the coast southeast we saw not a single sign of reindeer. I followed our usual method of hunting inland parallel to the course of the sleds, which followed the coast from promontory to promontory. Both the sick men now rode. The dogs were getting tired from hard work every day for weeks. When we landed we had left for them only two slim meals, consisting of worn-out and other not pressingly needed boots and various skin clothes. For ourselves we had food for about six days at half rations. As we were several hundred miles from our vessels, with sick men and tired dogs, the situation would have been serious had we not been equipped to secure food as we went along. As it was, the chances were several to one that we could shoot something before our strength gave out.

And so it proved. The second day ashore I found fourteen reindeer and got them all. Three days later both invalids told me that nearly all their symptoms of pain and distress were gone and that when they lay still they felt well. They were, however, too weak to walk, their teeth were so loose as to be easily plucked out by the fingers, and their gums were of a consistency nearly approaching that of cheese or of the white of a hard-boiled egg and could be cut with a toothpick easily. Two weeks later the teeth were firm in their sockets, the gums were harder, though not back to natural firmness, and the men felt perfectly well and eager to be moving. When we started, however, they did not prove to be able to walk more than five miles a day for the first few days. The rest of the time they rode, for our dogs had gained strength by their rest and ample feeding on reindeer meat.

Sojourn in Isachsen Land

During our seventeen days in Isachsen Land we rated our watches, finding the rate to be practically what it was in the winter. We killed about thirty reindeer and saw a half dozen more. There are no muskoxen in any of the islands discovered by us nor in the Ringnes Islands, nor did we see the track of a bear from leaving the home camp in Melville Island

till reaching the south side of Ellef Ringnes Island on our way home. The reindeer are only half the size here of the Barren Ground caribou of the Horton River or Coppermine River country on the mainland, so we needed every pound of the meat we killed for ourselves and the dogs. In our hunting we made some corrections in the outline of Isachsen Land, which we found considerably narrower than indicated on Admiralty Chart 2118. It is also highly probable that the Dyrebugten and Dronning Louise Fjord are not two bays, as shown on the chart, but a strait separating Isachsen Land from Ellef Ringnes Island proper. It looked so to us from the high land of Isachsen Land, but there is a chance we were deceived by a fog. Certainly, were it not for Captain Isachsen's map we should, had we been the original discoverers, have set this down as a strait.

Southward by Way of Third Island and East Coast of Melville Island

From the southwestern corner of Ellef Ringnes Island we crossed to our Third Island but were unfortunate in finding no seal hole through which to sound. The ice was all of the paleocrystic type, and Emiu, who had crossed this sea in Castel's party the year before, recognized pressure ice previously seen, so we know this ice did not move in 1916. We also know that the ice between First Island and Melville Island moved neither in 1915 nor in 1916. It is clear, however, that this ice moves in certain seasons. The inner part of Hecla and Griper Bay thawed in 1916, but the outer ice did not move. Liddon Gulf was open in 1916, but its ice did not shift in 1915. Byam Martin Channel is undoubtedlly open every season, for its remarkably strong currents were already shifting the ice in early June, 1917, making a break-up in early July probable.

In 1916 we had spent 27 days at a point near the southern end of Third Island, where we had that year carefully rated our watches. We now secured a reliable observation at the same place, and by going directly thence to Parry Rock at Winter Harbor we "tied up" our observations with that well-located spot.

On our way south along the eastern coast of Melville Island we examined two cairns without finding any records, though no one has visited those places since the Franklin Search. On the southeastern corner of Melville Island and at various points on the southern coast we picked up records of the Bernier expeditions.

Evidences of Coastal Elevation

Bears, seals, muskoxen, and reindeer abound on the eastern coast of Melville Island. On the southern third of the east coast we found the skeleton of a moderately large bowhead whale several hundred yards inland and —as I remember it—twenty or thirty feet above sea level. From the embayed character and drowned valleys of the west coast of Banks Island it appears that that coast has sunk, though driftwood well above present

high water may indicate that a new elevating movement has commenced. But all our new islands as well as the Ringnes Islands show clear evidences of extensive elevation of coast lines, which still is in progress. A log of driftwood found on the southern coast of First Island is so much larger than any driftwood now found on the mainland coast that the presumption is it did not come from either the Yukon or the Mackenzie River system—at least, it could not have come from any forests now flourishing there. This log is some distance above present high water. Generally speaking, there is no driftwood in any of the islands discovered by us.

We found a tusk, but no other mammoth remains, in Melville Island. Crustacean fossils have been found in various islands. Formation of ground ice, as previously described in a contribution of mine to the *Bulletin of the American Geographical Society*,[1] was observed in active progress in various places, notably near Cape Isachsen, on the northwestern coast of Second Island, and in Hassel Sound. The elevated beaches in these islands are marked in part by hummocks originally formed by ice pressure that thrust tongues of ice into the beach and thus buried ice fragments there.

Across to Banks Island

We stayed three days at the Kellett-M'Clintock cache on Dealy Island. The new roof placed on it by Bernier was of no service for the same reason that the original roof was inadequate—the house is built near a cliff several hundred feet high, and the snow consequently piles over it to such a depth that the weight of it needs must crush any ordinary roof. On July 3 only the southeastern corner was seen sticking out of the snow bank, but three days of exceptionally hot weather revealed the whole house. About half the stores are still fit, and certain foods, such as currants in barrels, are better than any fresh we ever tasted. Keeping them, under the conditions of this cache, has improved them somewhat as a similar storing would improve wine.

From Cape Providence we crossed to John Russell Point, running a line of soundings across with an average depth of 450 meters and an abrupt sea bottom slope towards both lands. We reached Banks Island July 25 to find the ice in Prince of Wales Straits already in motion. Proceeding south along the coast we later found that the straits could have been navigated as far north as the excellent harbor at John Russell Point as early as the first week of August. From the remarkably ice-free condition of these straits in the summer of 1916 also, I judge that the Northwest Passage as discovered by McClure is no more hazardous or likely to be interrupted in Prince of Wales Straits or Melville Sound than it is in several other of its links, such as, for example, the rounding of Point Barrow.

A short way (about five miles) south of what probably is intended for

[1] Underground Ice in Northern Alaska, Vol. 42, 1910, pp. 337-345.

John Russell Point we found a copper cylinder containing a record signed by McClure saying, in substance, that from this point he had seen the waters of Melville Sound, thus discovering the Northwest Passage. The document had been written by someone other than McClure. It was dated aboard the *Investigator* in winter quarters in the spring of 1851 and had been sent to this point to record the discovery made the preceding autumn. The winter had been comfortable; there was no serious illness aboard; the cache on Princess Royal Islands is described; and a request is added that the record be forwarded to the Secretary of the Admiralty. The cairn for this record must have been solely of sand, for no vestige of it had been left by the strong winds that are frequent in this region. As the land does not conform well with the chart here, the discovery of this record was a remarkable accident—I was hunting reindeer and found it on the level north bank of a small stream about half a mile inland.

Corrected Position of Northeastern Cape

The record says that John Russell Point was located by lunar distances. The well-known uncertainty of this type of observation, especially if made but once and under the discomfort of cold weather, may account for the fact that our time observations here, when referred to Winter Harbor as given by Bowditch, place John Russell Point about a degree of longitude farther west than does Chart 2118. In conformity with this result, we found the northeastern corner of Banks Island to be far less peninsular in its outline than the chart indicates—the map makers seem to have stretched the land eastward to meet the requirements of an incorrectly determined longitude.

Interior Drainage of Banks Island

A comparative scarcity of game compelled us to abandon the coast after about fifty miles—otherwise we should have followed it south to Jesse Bay, crossing thence to Cape Kellett, for I should have liked to make a new survey of the coast. However, the overland journey had its compensations, for we found some large lakes that are the headwaters of the large river that enters the sea about six miles west of the Bay of Mercy. These lakes lie less than ten miles from the east coast of Banks Island, just north of the Princess Royal Islands. We can now locate with rough accuracy all the watersheds of Banks Island. The main one runs from just east of the Bay of Mercy to a point within about five miles from the eastern coast near the Princess Royal Islands and thence roughly to Nelson Head. By far the largest river is the one which in 1915 we traced from its mouth just west of the Bay of Mercy to where it is about 20 miles from the eastern coast a little north of 73° N. and the lakes of whose headwaters we have now found a little to the southeast. This gives a canoe route uninterrupted by serious rapids and deep enough for a small gasolene launch from within ten miles of the middle of the eastern coast of Banks Island to McClure Strait.

Coal on Banks Island

We had abandoned our two sleds near John Russell Point and were traveling with thirteen pack dogs at the rate of about ten miles per day, a common average under such conditions. In the interior of the island we discovered a coal mine. Captain Beneard had found coal afloat a year earlier near Cape Kellett, and there is probably a deposit to be found up one of the small stream beds there. Coal is also found at many points along the northern coast of the island. The deposit 80 miles east-northeast from Cape Kellett burns in the manner of thoroughly dry wood and with a fragrant smoke; the other deposits are real lignite of various degrees of excellence. We have specimens of coal from most of the deposits noted as well as of rock from several places in each of the islands discovered or visited.

Arrival at Cape Kellett

On arriving at Cape Kellett August 17 we found the *Mary Sachs* had been repaired and launched by Castel's party according to my orders but had later on been made unseaworthy and was now a wreck broadside on the beach. From two men, Otto Binder and Gustav Massik, to whom the remains of our Kellett base had been turned over as a trapping camp, we learned the surprising news that we had not been expected back at Cape Kellett that summer and that the *Polar Bear* and all our men had left Banks Island August 12, the captain saying the season was so late he did not dare to stay longer.

We learned, also, of a tragedy of the previous winter. Captain Peter Beneard and Karl Thomsen had attempted in the midwinter to carry mail to us in Melville Island and had lost their lives. Our search party had found the body of Thomsen but had not found Beneard or the mail. As no white person survived at Cape Kellett and Beneard had confided nothing to the Eskimos, we do not yet know why this trip was attempted, as my instructions to Beneard were that he was not to leave the Cape Kellett base and that no attempt should be made to bring us mail. Doubtless Beneard saw some special reason for not following those instructions, for he had through the whole expedition been one of our most faithful and trustworthy men.

Departure for Cape Bathurst and Herschel Island

It looked the latter part of August as if we were destined to be marooned on Banks Island. We should have suffered no want, for game is reasonably abundant, but through lack of equipment we should have been able to do no scientific work and the year would therefore have been tedious because unprofitable. The prospect was brightened the last days of August by the arrival of the trading schooner *Challenge*, which I promptly bought and with which we sailed inside the twenty-four hours. We had little hope of overhauling the *Polar Bear*, which now had two weeks the advantage of us.

But it later developed that her hurry to leave the Arctic had not been equal to her desire to get away from Cape Kellett and that she had gone to Cape Parry, had hunted caribou there for some days, and, on finding game scarce, had returned to Banks Island in the vicinity of Nelson Head, where several days were spent. As a result, we met her near Cape Bathurst the morning after we left Cape Kellett. The *Challenge* was now of no further use and I sold her at the Baillie Islands (Cape Bathurst).

The captain was discharged at the Baillie Islands and the mate at Herschel Island. John Hadley, who had been carpenter on the *Karluk* and second mate on the *Polar Bear* and had done his work on this expedition with exceptional fidelity, was now promoted to be captain, with Castel for mate and Massik for second mate. Storkersen's exceptional value as a field man had prevented me from making him an officer of any of our ships, for to us the work of the sleds and dogs was much more valuable than that of the ships, which so far had not succeeded in co-operating efficiently with the sled workers. The best base we ever had was that established by Wilkins and Castel with the *North Star* near the northwestern corner of Banks Island in 1915. The year before had been a much better ice season, but in 1915 she could not be taken farther north than Wilkins took her, for the ice north of that point was found by him unbroken and remained so till the freeze-up.

Herschel Island to Barter Island

We left Herschel Island about September 10. It had been a bad ice year. The whaler *Herman* under Captain Pedersen's competent direction had been able to proceed but a few miles beyond Cape Bathurst and the Hudson's Bay Company's *Macpherson* had taken the *Herman's* failure as conclusive and had not proceeded beyond their post at Bathurst. There was much scattered ice everywhere about Herschel Island; so darkness and fog interfered with our running at night. At the Alaska-Canada boundary Mr. Thomas Gordon of the trading post there told us that the *Herman* had left there some time before, much in doubt of her ability to get out of the Arctic. Mr. Gordon urged our not trying to get out, for he expected the freeze-up any day and we might get caught at an unsafe point on the coast. It now seems likely we should have had no difficulty in getting out, however, but for an unfortunate accident at Barter Island.

We arrived at Barter Island the evening of September 12 at the concomitant closing in of darkness and a fog. There was scattered ice and a strong north-northeast breeze. We decided to tie up in the Barter Island harbor till daylight of the 13th, as fog, darkness, and a high wind go badly together in the midst of ice.

Detention for Another Winter Through Grounding of Vessel

Towards morning, in the mate's watch, Mr. Castel called me and reported that within the hour the wind had shifted from the north-northeast to

southwest and was rapidly freshening to a gale. I directed him to call the captain, but before the captain reached the deck the vessel bumped bottom, and before we could do anything we were broadside on a shoal within the harbor. It was the opinion of both captain and mate that it was hopeless to try getting afloat till the wind slackened. It is, however, a well-known fact that a gale of this type is commonly preceded by several hours by a rise of tide, usually five feet or over in this region. So it had been now, and before the wind abated the tide had fallen sufficiently so that it was impossible to get afloat till there should be a second southwest gale. This did not come before September 26. By that time the vessel had been unloaded. By putting out both anchors and by the simultaneous use of propeller and winch we got afloat before that gale attained a high enough pitch to prevent our swinging the ship's nose against it. But I feared the time was now too late for a safe passage out, and so we stayed. I now think I was probably wrong in this and that the fall of 1917 was so especially late that we could have left Barter Island the last of September and reached the Pacific before the ice caught us. But in the average season, the last week of September is too late for an easy passage out, and this year we all were obsessed with the premonition of an early fall.

Plans for Spring Expedition

When once it was clear that we had to winter it became equally clear that we ought to do some exploratory work the coming spring, for here we were in fairly easy reach of the unexplored area, with a better equipment on hand or easily available than we had ever had before and many men drawing pay for work that would be purely non-productive unless we did some spring traveling. Of course there would be some added expense, but then we should have something to show for the money spent.

The plan I settled on was to go with all available equipment about 200 miles north from Cross Island, Alaska (148° W.). From here I would send home all but three or four men and two dog teams, select the thickest available ice cake, spend the summer in accumulating meat and blubber for winter, float where the ice listed till February or March, 1919, and then start for the nearest land. On the going home of our Southern Division in 1916 we had received good sounding wire and many needed instruments from them and were therefore in a position to take soundings and some other desirable observations, besides the astronomic, as we drifted from place to place.

Attack of Typhoid

To prepare for this work I went to the Mackenzie delta in the autumn to buy dogs, dried fish for dog food, etc. Meantime Castel maintained at Cross Island a sealing station to provide dog food, and Storkersen and Hadley prepared everything else needed at the ship—such things as sleds,

clothing, condensed rations for men and dogs, etc. I succeeded in buying in the Mackenzie delta (with the invaluable assistance of the Royal North West Mounted Police and the Hudson's Bay Company) some fifty of the best dogs we ever had. In every way our prospects looked excellent, when, the first week of January, with everything ready for a start out on the sea ice by the full moon of February, I was taken with typhoid of a severe form. I probably owe my life to being able to travel from Shingle Point during the first four days of my illness to the Police Barracks at Herschel Island, where I received the best care available from the police, from the missionary, and from every white man in the village.

Transference of Expedition to Storkersen

So soon as we realized it was typhoid (which was not till I was down with pneumonia complications after a partial convalescence) it became clear that Storkersen would have to take my place in the ice work. By this time the start had already been delayed for my expected recovery from what we at first took to be an illness of not very serious type, and it was not until after the middle of March that Storkersen finally left the land at Cross Island. I do not as yet know any exact details, but I believe he had ten good sleds with about five good and five average teams, in all about eighty dogs. There probably were about fifteen men, five or so of them Eskimos. The Eskimos of this part of the Arctic, however, can be used for the first support parties only, for two reasons: they are afraid of going far from land on the moving ice, and they are unwilling to live on meat only, which all those have to do who accompany the advance beyond the limit of the provisions hauled from home.

For the present Storkersen's chances of success look good. He has ten sleds against the three we had on the corresponding trip in 1914; most of his sleds are good ones, while only one of our three was good in 1914; his dogs average much better than ours, and he will be able to pick two six-dog teams at the last where each dog will be equal to our good ones of 1914, when the good dogs were only four in number.

It proved, however, that the plan of drifting for a year on the ice had to be abandoned when I could not myself go. I then expected that Storkersen would go about north to 74° N. and then west and south to Wrangell Island or Siberia, keeping about a hundred miles outside the *Karluk* drift track. I have received no report from Storkersen or Hadley since Storkersen left me ill at Herschel Island, but it is now rumored that instead of going north and west Storkersen plans to go north and east, perhaps to Cape Murray. This is entirely feasible, if he has as good luck as we had in 1914, for he got an earlier start and has better sleds and dogs, but there is the disadvantage of his having to cross areas we have already explored should he not be able to get beyond 76° N. Should he land on First Island or Prince Patrick Island before July 10 he should reach

Kellett before the end of August, in which case he will be picked up there by the Hudson Bay Company's *Macpherson,* which now aims each year to supply the new trading post Fort Bacon on Dolphin and Union Straits and therefore passes the south end of Banks Island twice a year. They will call at Cape Kellett in September or late August this year and pick up Storkersen's party, unless another vessel picks them up sooner. Two vessels that may call there are the *Herman,* which, I suppose, is still under command of Captain Pedersen, and Leffingwell's *Argo,* now owned by Mr. Samuel McIntyre.

Storkersen probably carries about 2,500 meters of sounding wire. He has three excellent watches besides the two we had before and is in every way better equipped than any of our parties previously have been.

Journey from Herschel Island to Fort Yukon

After being in bed at Herschel Island from January 13 to April 3 I finally left on that date for the Episcopal Hospital at Fort Yukon. This is the only hospital within five hundred miles of Herschel Island (as one must travel) and even the only place with either doctors or nurses. Mr. Henry Fry, the missionary at Herschel Island who had been doing all in his power for me, had finally arrived at the conclusion that I should probably not live through if I stayed there and that something else must be tried. Inspector Phillips of the Police had arrived at the same conclusion and now volunteered to undertake the superintendence of my preparations and my journey south should I want to go. I had wanted to go a week or ten days earlier, but had then been dissuaded from doing so by those who thought the journey might be beyond my strength. Now that all agreed I must go south, Inspector Phillips soon had the party ready, and under the charge of Constable Brockie we started on April 13 with two Eskimos and an Indian driving three sleds. Mr. Fry at first intended accompanying us, but, when the first day's journey showed no ill effects but on the contrary marked improvement in lower fever and increased appetite, he saw that he was not needed and turned back. It took us eleven days to the Porcupine River at the mouth of the Old Crow River.

A week or more before I left Herschel Island a party of three Indians from the Porcupine basin at the head of the Old Crow River came to the island to buy certain things from the Hudson's Bay Company's store there. I had heard before of the presence of a physician at Fort Yukon but did not know but the war or other conditions might have taken him away. One of the Indians offered to carry a message for me to Fort Yukon and to accompany the doctor thence to Herschel Island should he be willing and able to come. But at Herschel Island the opinion prevailed, and was even shared by me, that the doctor would probably not come. At the mouth of the Old Crow, Mr. and Mrs. Schulz of the trading post there told me from intimate acquaintance with Dr. Burke of Fort Yukon that he would

STEFANSSON'S AND MAC MILLAN'S
RECENT EXPLORATIONS
IN THE
AMERICAN ARCTIC ARCHIPELAGO
Scale 1:9 500 000
100 50 0 100 200 300 miles
Routes
Canadian Arctic Expedition
Northern Division
Stefansson
Storkersen
Crocker Land Expedition
Mac Millan
Ekblaw
Base or winter quarters
All routes are approximate, and
Stefansson's 1916 routes are conjectural
Revised from THE GEOGR REVIEW, MAR 1918
GREENLAND
ELLESMERE ISLAND
GRANT LAND
KANE BASIN
AXEL HEIBERG I.
NORWEGIAN BAY
JONES SOUND
NORTH DEVON
LANCASTER SOUND
BARROW STRAIT
NORTH SOMERSET
BAFFIN I.
PRINCE OF WALES ISLAND
MELVILLE SD.
MELVILLE I.
BATHURST I.
PRINCE PATRICK I.
BANKS ISLAND
BEAUFORT SEA
VICTORIA ISLAND
PRINCE ALBERT SD.
KING WILLIAM I.
BOOTHIA PENA
McCLINTOCK CHAN.
McCLURE STRAIT
CORONATION GULF
Dolphin and Union Str.
ALASKA
Mackenzie R.
Porcupine R.
Horton River
C. Thomas Hubbard
2nd new island
1st new island
3rd new island
ISACHSEN LD (island?)
C. Malloch
C. Murray
C. Grassy
C. Providence
Cape Nansen
Cape Keltern
Mary Sachs
1914-17
Wynniatt Bay
Walker B.
Minto Inlet
Nelson Head
Baillie Is.
C. Parry
C. Bathurst
Herschel I.
Barter I.
Martin Pt.
Cape Mamen
Cape Southwest
Cape Northeast
Cape Farady
Roger Pt.
Sanders I.
Cary Is.
Clarence Head
Finlay I.
Paterson I.
Lands End
Deadly I.
Winter Har.
Dundas Pen.
Liddon Gulf
Russell Pt.
Peel Pt.
Princess Royal Is.
Prince Alfred
North Star
1915-17
Norway I.
Bay Mercy
Withrow B.
Harrison Str.
Smaller Mts.
Tyler Bear
1916-17
Sachsen
1914-16
Bernard Harbour
Byam Martin Is.
Mac Mc
Apr 1916
NORTH CORNWALL
King Christian
St. July 1916
AMUND RINGNES I.
ELLER RINGNES I.
Cape Mamen
Cape Southwest May 1916
Cape Northeast May 1916
Cape Farady
Roger Pt.
Sanders I.
Cary Is.
Clarence Head
Finlay I.
Paterson I.
Lands End
Deadly I.
Winter Har.
Dundas Pen.
Liddon Gulf
Russell Pt.
Peel Pt.
Princess Royal Is.
Prince Alfred
North Star
1915-17
Norway I.
Bay Mercy
Withrow B.
Harrison Str.
Smaller Mts.
Tyler Bear
1916-17
Sachsen
1914-16
Bernard Harbour
Byam Martin Is.
Mac Mc
Apr 1916
NORTH CORNWALL
King Christian
St. July 1916
AMUND RINGNES I.
ELLER RINGNES I.
April 1914
May 1914
June 1914
March
August
Sept 1917
Aug 1917
Dec 1915
Jan 1916
Sept 1915
Aug 1915
July 1917
June 1916
May 1916
April 1916
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Apr 1917
Mar 1917
Aug 1916
Sept 1916

go to Herschel Island or anywhere else to help anyone seriously ill. I learned here also that my Indian messenger had been traveling down the Porcupine too slowly to suit the white men of that country, and that one of these, Mr. Harry Anthony, had with his better dog team taken the Indian's place and carried my letter to Fort Yukon. I was told that Mr. Anthony would have arrived at Fort Yukon by now and that if I waited the doctor would soon be at the Old Crow and if I kept on I should meet him on the road. As the journey seemed to be doing me good I decided to go on. And indeed at Old Rampart House we met Dr. Burke and his party. They were bound for Herschel Island to spend the summer there or return sooner, as circumstances demanded.

On meeting us, Dr. Burke turned back and we proceeded leisurely towards Fort Yukon. On the way there we were overtaken by the Reverend Hudson Stuck, Archdeacon of the Yukon, who was returning from a journey to Point Hope and Point Barrow and who had reached Herschel Island a day after we left there. We arrived at Fort Yukon on April 27, where my convalescence proceeded satisfactorily at the St. Stephen's (Episcopal) Hospital.

As we expect vessels that must go to Banks Island anyway to pick up Storkersen's party if they come to Cape Kellett, my orders provide that Captain Hadley shall bring the *Polar Bear* to Nome so soon as ice conditions allow. If health permits, I may meet her there in August or September, or I may come south direct. In either case the vessel will probably proceed to the Esquimalt Navy Yard at Victoria, British Columbia.[2]

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[2] Press despatches reported the arrival of Stefánsson on September 18, at Vancouver, B. C., on his way east. He will lecture before the American Museum of Natural History and the American Geographical Society on October 31.—EDIT. NOTE.

GEOGRAPHICAL RECORD

THE AMERICAN GEOGRAPHICAL SOCIETY

The Lecture Season of 1918-1919. The lecture program for the coming season will include addresses by distinguished explorers and geographical writers on subjects of current interest. The dates are as follows: October 31, November 19, December 10, December 17, January 7, January 21, February 11, February 25, March 11, March 25, April 8, April 22. The lectures will be given, as usual, in the auditorium of the Engineering Societies' Building, 29 West Thirty-ninth Street. On October 31 Vilhjálmur Stefánsson will lecture on his four years' expedition to the Arctic, from which he has just returned and about the latter half of which he reports in the present number of the *Review*. Later Mr. Theodoor de Booy will lecture on his recent expedition, conducted under the auspices of this Society, to the Sierra Perijá of Venezuela, about which brief mention was made in the August *Review* (p. 172). Another speaker will be Major Douglas W. Johnson, who will give an address on the field studies he has undertaken during the past year under the auspices of this Society as a basis for a report on the relation of physical geography and topography to military strategy.

SOUTH AMERICA

Irrigation in Chile. Central Chile is the granary of the west coast of South America. It must supply the nitrate workers of the desert north and the sheep men of bleak Magellan. This condition is accentuated by the present world crisis in foodstuffs. But from the Aconcagua to the Maule (32⅔°-35½° S.) there is a yearly average of less than 20 inches of rainfall, and, unfortunately, that all occurs in the winter months. The summers are cloudless, dry, dusty. Most of the hillsides and much of the valley floor have been used for nothing but grazing, and for that only during the rainy season. The herds of horses, cattle, and sheep from the *haciendas* are driven to the high mountain grass lands in early spring, their *huaso* herdsmen remaining there with them until winter rains freshen the hillside pastures and untilled flats of the central valley. In addition to this unfavorable distribution of rainfall, the amount varies greatly from year to year. In 1886 at Santiago there were only 4.99 inches, while in 1900 there were 32.26 inches. Rains are brought by the north winds that accompany passing cyclonic centers. These centers often move across the Cape Horn region, and at such times central Chile is well beyond their influence (R. C. Mossman: Southern Hemisphere Seasonal Correlations, *Symons's Meteorol. Journ.*, Vol. 48, 1913, seven articles; reference on page 2). Hence Chile has long depended upon irrigation. From Inca times the sediment-laden waters of her numerous streams, that, rising at an elevation of some 10,000 feet in the Andes, reach sea level in less than 150 miles, have been utilized for agriculture. The fields along the river terraces within the Cordillera and the great estates on the piedmont slopes and deep alluvial plains of the central valley would be unproductive were it not for the waters of the Aconcagua, Maipo, Rapel, Maule, Itata, and Bio Bio Rivers. Every mountainside carries its canal, sometimes hanging high up on the slope, sometimes fringing the foothills. Lines of Lombardy poplars and weeping willows border these watercourses, dividing the farms up like checkerboards. The great Maipo canal has been in operation for over a century. Associations of land owners, in some cases individual *hacendados*, have maintained these irrigation systems. Besides turning the river waters upon their land, many Chilean farmers have constructed reservoirs to catch and hold winter rains for use during the growing season (see Roberto Opazo G.: Los problemas del regadío, *Bol. Inspecc. de Geogr. y Minas*, Vol. 11, 1915, pp. 271-283, Santiago de Chile). These efforts have made a veritable garden out of a region which otherwise would produce little else than thorny shrubs.

But until recently all irrigation was the result of private enterprise. Consequently, much land was left untilled, and Chile imported wheat from Australia, Uruguay, and California. Now, however, the government (composed almost entirely of wealthy farmers) is making an effort to increase agricultural products. They realize that the nation must be made less dependent upon its great but insecure monopoly of nitrate and must be more self-sustaining, too, in its food supply. Fiscal aid is being extended to the construction of irrigation works. Several extensive projects are under way or already completed. In the beautiful horticultural region of Nos, a few miles from Santiago, an

extensive plant has been installed. It waters 25,000 hectares, or about 62,000 acres (*Bull. Pan Amer. Union*, March, 1912, p. 372). The Cachapoal canal, also made possible by the government loan policy, irrigates 300,000 hectares of grain fields, vineyards, and orchards. Near the Laja River some 45,000 hectares will be made more productive by canals leading from this stream. A very pretentious project that has been approved by the Department of Public Works is that by which canals and tunnels will carry water from the Melado, a mountain tributary of the Maule, through an intervening ridge into the valley of the Ancoa, and from there to the farms of Linares. This is one of the best wheat sections of the country. It also produces excellent grapes and apples. Irrigation on this large scale will reclaim many acres of hitherto uncultivated land (*South Amer. Journ.*, July 28, 1917, p. 56). Even districts in the north are to profit by the government's interest in agriculture. One of the plans includes the construction of dams and reservoirs on the upper Coquimbo, by which it will be possible to irrigate the entire valley (*South Amer. Journ.*, Aug. 11, 1917, p. 86). Coquimbo raisins are famous along the west coast.

As is well known much of the soil in the northern provinces is productive if watered. Evidence of this is furnished by the rapid growth of flowers and grass after each infrequent rain in that desert region and by the band of vegetation that marks the cloud line along the barren coastal range.

Greater use of the Chilean streams for irrigation should also aid in preventing the disastrous floods in many of the rivers, caused in spring by rapid melting of the snow fields and in winter by the occasional heavy rains.

AFRICA

The Faunal Regions of Africa, Based on the Distribution of Fishes. The zoögeographical regions of Ethiopian Africa, i. e. Africa south of the Sahara, as established by Wallace, were four in number—West, East, and South Africa, and Madagascar with the Mascarenes. Recent discoveries have shown that many forms then believed to be peculiar to South Africa are common to East Africa also. Today the zoögeographer, as Heller says elsewhere in this number of the *Review* (p. 301), recognizes two primary divisions of the continent (excluding Madagascar): (1) the humid and forested west and (2) the comparatively dry east and south. With the faunal regions the floral are in general agreement. From the work of Engler (see especially: Pflanzengeographische Gliederung von Afrika, *Sitzungsber. Kgl. Preuss. Akad. Wiss.*, 1908, Part 2; Die Pflanzenwelt Afrikas, Vol. 1, in two parts, Leipzig, 1910) the boundaries of the floral divisions and their subdivisions have been worked out and represented on a map by members of the staff of the American Museum of Natural History (Engler's own map may appear in Vol. 5 of his "Pflanzenwelt Afrikas"; see, under Engler, page 379 of this number). Their map is reproduced on page 744 of a memoir on the "Freshwater Fishes of the Congo Basin" by J. T. Nichols and Ludlow Griscom and is used to illustrate the general conformity with the ichthyfaunal regions of the continent as worked out by them (Scientific Results of the American Museum of Natural History Congo Expedition, 1909-1915; Ichthyology, No. 1, *Bull. Amer. Mus. Nat. Hist.*, Vol. 37, 1917, pp. 653-756).

On the basis of its freshwater fishes the continent in its entirety may be divided into five regions (map on p. 741 of memoir): Northwest Africa; West Tropical Africa (i. e. from the Niger to Angola and west of the Great Lakes); the Nile Basin and Northeast Africa; East Africa with South Africa; Madagascar. The northwestern region is purely northern (Holaretic) in character, the relations with European forms being very close. It coincides with Engler's Mediterranean region. The Madagascar region has no real ichthyological affinities with the mainland. For the remainder of the continent the great dividing line is between the west and the east with the south. The fish fauna of West Tropical Africa is entirely distinctive, and it is much the richest of any of the African divisions. Where the forms of the east are of northern or oriental origin those of western Africa also include many peculiar forms and forms of primitive character which either originated in Africa or have survived there only. The Nile Basin and the northeastern division, which corresponds with Engler's northeastern subprovince, shows a mingling of forms, European and Asiatic and West African. The East African region is as poor in fish fauna as it is rich in the larger mammalian fauna. Most species are related to those of the Nile Basin, and the few western forms appear to have been derived from this source. Lake Tanganyika presents a problem, and a definite position has not been assigned to it. The paucity of forms increases southward, and there appears no reason for making a separate faunal region out of South Africa. However, in the extreme southwest, round Cape Town, there is found the single peculiar African form that is not West Tropical in its range; this is *Galaxias*, confined to the very limited area that Engler separates as a distinct region on the basis of its aberrant flora.

The distribution of peculiar forms has important bearing on the problem of the Antarctic Continent, one of the remnants of ancient Gondwanaland, evidence for which has lately received strong support through the *Glossopteris* flora brought back by the *Terra Nova* expedition from latitude 85° S. (A. C. Seward: Antarctic Fossil Plants, Natural History Results of the British Antarctic ("Terra Nova") Expedition, 1910, Geology, Vol. 1, No. 1, pp. 1-49, 1914). From data now available it appears not improbable that the ancient and primitive types of African fishes originated in South Africa or some other part of the then continent of Gondwanaland which enjoyed humid conditions. Desiccation would cause these forms to become extinct or to migrate to regions of more favorable conditions—to western Africa, where they have persisted.

On Future Boundaries in Central Africa. In tropical Africa, where territorial division has been so rapid a process in so little known a land, boundaries have been developed on the doctrines of *hinterland* and *spheres of influence* (Curzon's "Frontiers," 1907, pp. 43, 44). In consequence the "artificial" frontier figures largely. Such boundaries can only be regarded as preliminary lines. Already certain adjustments have been made; but it is the reconstruction following the war that will give the great opportunity for boundary reform. Tentative suggestions of reform have been put forward in an article "A Central African Confederation" appearing in the *Journal of the African Society* (July, 1918, pp. 276-306, with map, 1:12,000,000) above the signature "Africanus." Discussion is limited to eastern tropical Africa on the thesis that the future shall see a compact British territory from south of the Sudan and Abyssinia to the Zambezi and east of the Belgian Congo and Angola to the Indian Ocean and Mozambique.

In this region existing boundaries are boldly discarded. In place of the existing divisions of Uganda, British East Africa, and German East Africa, and in opposition to amalgamations of the two former or the two latter, as has been proposed, there is propounded a longitudinal division following the main natural divisions of the country. These divisions include a coastal belt running from the Juba to the Rovuma; a highland belt from south of Lake Rudolph to the Mahenge plateau, and a modified Uganda, centered round Victoria Nyanza by addition of the Kavirondo country of British East Africa and of the German territory draining to the lake. It is further proposed to take parts of the Nile and Rudolph provinces from the present Uganda and add them to the Sudan. Northern Rhodesia would remain practically unchanged save for a small addition of similar country round the southeastern end of Lake Tanganyika. The southern plateaus of German East Africa would be added to Nyasaland, giving this heretofore cramped province the head of Lake Nyasa.

The geographical basis for the first three of these divisions is very clearly marked. The coastal belt is the region of tropical plantations. Here, if it be deemed advisable, would be the suitable region for East Indian colonization. The highland belt includes the areas suitable for white settlement. Quite different are the problems in Uganda, which must remain a black man's country. The selection of natural regions for administrative units in the case of these three divisions ignores a principle which the statesman-geographer recognizes as one of the cornerstones of his policy. This is that, to insure stability and permanence, a state should have, second only to racial unity, a diversity of natural regions, in order to make full use of the interplay of economic forces which such a composition implies. However, this principle might be considered less valid in the case of colonies which, because of the stage of their development, were not suited to self-government.

The location of the centralized authority of the confederation is a matter of importance. The question of a central administration for the British possessions in eastern Africa has been discussed before, and Zanzibar has been suggested as the seat for such administration. The present proposal would place that seat in Kivu or some other part of Ruanda. This is as far west as Zanzibar is east, but the situation is splendidly healthful, and the lack of communications, at present the great obstacle, could be amended. The fate of Ruanda as a whole is particularly interesting: though it is a region suitable for white settlement it has a dense native population. Here it is suggested that, excluding an area for the seat of the proposed federal administration, the remainder should be constituted a native reserve.

Mount Kenya: Notes on the Geography of an Equatorial Snow Peak. A snowy equatorial peak should prove an object of particular attraction to the geographer: few, however, have been the observations on Mount Kenya, over 17,000 feet high and lying exactly on the equator east of the Great Rift valley of east-central Africa. The more accessible Kilimanjaro is better known; likewise Ruwenzori. The chief expeditions to Kenya have confined themselves to its western slopes. Teleki, the first European to ascend Kenya above tree line (1887), J. W. Gregory (1893), and Mackinder, who has

made the first and only ascent to the summit (1899), all made their explorations from the west. The Roosevelt expedition skirted the western and northern slopes of the mountain. An attempt on the southeastern slope was made by Dundas in 1891, but the highest point reached was only 8,700 feet. Five years later Kolb reached much the same position on the southeast, while on the northeast he attained a considerably greater altitude (George Kolb: Von Mombasa durch Ukambani zum Kenia, *Petermanns Mitt.*, Vol. 42, 1896, with map, 1:1,000,000, Pl. 17). Hutchins, while engaged in a forest survey of British East Africa, made a complete circuit of Kenya, for most of the distance at an altitude of 12,000 feet, and he has contributed our chief knowledge of the southeastern part of the mountain (Report on the Forests of Kenia, East Africa Protectorate, *Colonial Rept. No. 41*, 1907; see also "Report on the Forests of British East Africa," *British Parliamentary Paper Cd. 4723*, 1909, and A Visit to Mount Kenia, *Scottish Geogr. Mag.*, Vol. 25, 1909, pp. 346-352).

There are considerable differences in zonal distribution between the eastern and western sides of the mountain, especially in the lower forest zone, which is economically the most important. On the west the forest begins at an elevation of 7,000 to 7,500 feet. For the northwest Alluaud and Jeannel place it as high as 7,870 feet (Le Mont Kénya en Afrique Orientale Anglaise, *Rev. Gén. des Sci.*, July 15, 1914, pp. 639-644). On the southeast the lower edge of the forest begins about 6,000 feet. Here it is much denser, and the place of the distinctive juniper (cedar) of the west is taken by great camphor trees. The drier west appears to have suffered greatly from fire, and the higher altitude at which the forest begins may be due in part at least to the destructive grazing fires of the Masai. Evidently precipitation is the dominant factor controlling the differences of the vegetational zones. Kenya is exposed to prevailing easterly winds (southeast trade, northeast monsoon). Hutchins estimated that, where the rainfall of the southeastern slope was 80 to 120 inches a year, that of the west was 50 to 90 inches.

The most recent observations on Kenya by Captain G. St. J. Orde Brown (The Southeast Face of Mount Kenya, *Geogr. Journ.*, June, 1918, pp. 389-392) emphasize the extreme humidity on the mountain, a fact which explains the low limit of snow (about 14,500 feet on the southeast), as von Höhnel, Teleki's companion, comments, lower than that of Kilimanjaro (Ostäquatorial-Afrika, zwischen Pangani und dem neuentdeckten Rudolf-See, *Ergänzungsheft zu Petermanns Mitt. No. 99*, 1890). For at least nine months of the year Kenya is "covered with mist, varied by heavy rain"; in fact the only months when finer weather can be depended on are February and early March. A marked consequence of the heavy rainfall is seen in the high degree to which the southeastern face is eroded, the gorges here being cut much more deeply than on the other sides. The aspect of the summit from the south is described as presenting the appearance of a broken-down crater lip, from the western side of which the highest point projects as a rocky tooth. A similar interpretation was made by Teleki from the west, but Gregory proved that denudation has removed the original crater wall and that the final peak represents the eroded central core of the ancient volcano. Further exploration of the peak would be desirable, and, according to Captain Brown, who offers practical suggestions for such an undertaking, it should not prove difficult to anyone with mountaineering experience if made at the proper season of the year.

AUSTRALASIA AND OCEANIA

Rainfall Maps of Australia. The Australian Commonwealth Bureau of Meteorology, Melbourne, has distributed its rainfall maps for 1916 and 1917. For each year the mean annual rainfall is shown on a large sheet, on the reverse of which there are twelve small maps showing the monthly rainfall. On the latter the areas which had a rainfall above the average are shaded blue, while those which had no rainfall, or less than "10 points of rain," are colored light brown. The general conditions of excess or deficiency are thus clearly indicated. Another set of small charts shows, for the last eight or ten years, the areas which had above the average rainfall. The discussion of the mean annual precipitation for 1916 and 1917 is clear and instructive, an especially noteworthy feature of this discussion being the emphasis which is laid on the *controls* of the rainfall of each year. In far too many cases such a text is merely a statement of the *facts* of rainfall amount and distribution, which facts can, of course, be easily seen on the charts.

The year 1916 was a remarkable one on account of the extraordinarily abundant rainfalls of the winter, spring, and early summer. These seem to have been the direct result of remarkably sustained air movements from the tropics over the more temperate latitudes. From June to December there was no month in which the rainfall was not a record over some portion of the Commonwealth. Disastrous floods occurred in many sections, notably in September, early October, and again in December. Curiously enough,

the weather conditions in 1917 were very similar to those of the preceding year, the air movements from the tropics into higher latitudes being maintained practically throughout the year. Therefore, a record wet year was again recorded at many stations. It is an interesting fact that the air-drift from the tropics in 1917 appears to have been preponderantly from the northwest. Hence the rains were more abundantly distributed on the northwestern than on the southeastern slopes of the highlands on the eastern and southeastern coasts of Australia. Very disastrous floods occurred at many places during the year, as in 1916. The occurrence of these two years of unusually heavy rains naturally lends peculiar interest to the conditions of the years which are to follow and to the search for the ultimate causes of the marked air movement from the tropics which brought about these wet years. R. DEC. WARD

POLAR REGIONS

Recent Economic Developments in Spitzbergen. While much of eastern Spitzbergen remains unknown, the greater part of the west has been completely surveyed. With the exception of Prince Charles Foreland, a long island off the west coast, of which an exhaustive survey has been made by Dr. W. S. Bruce, the surveys have been conducted by Norwegians. Norway's scientific interest in Spitzbergen began in 1906 with the work carried out in King Haakon VII Land by Isachsen. The course of the successive Norwegian expeditions has been carefully followed in the contemporaneous issues of *La Géographie*. The last number of *La Géographie* (Vol. 32, 1918, pp. 96-101) gives a preliminary report of the 1917 expedition to Spitzbergen commanded by Adolf Hoel and Captain Sverre Rövig.

The work of the expedition was considerably impeded by unusual ice conditions, following an extraordinarily severe winter. The mean temperature of each month from October, 1916, to August, 1917, was below normal, April being 10° below. The work of the hydrographic party suffered most keenly. The field of their operations, from Ice Fiord to Bell Sound, the two major re-entrants penetrating from the west the south-central part of the main island, was not clear of ice until August 10 and was closed again on August 26 by masses of ice from the eastern pack doubling South Cape, the main island's southernmost point—a not uncommon event, as Rudmose Brown notes in commenting on the bad ice conditions of 1914 (R. N. Rudmose Brown: Spitsbergen in 1914, *Geogr. Journ.*, Vol. 45, 1915, pp. 10-23).

Topographic work was carried on in the territory pertaining to the Norwegian coal company west and south of Advent Bay, a small indentation on the southern side of Ice Fiord. For the company there was executed a map on the scale 1:10,000, which will permit of an accurate estimate of their coal resources.

The geologists completed the map of the coal-bearing region between Ice Fiord and Bell Sound and carried out researches south of the latter opening. The work accomplished represents the first part of a program designed to cover a period of five years, of which one of the primary objects is the extension of topographic and geologic surveys over the region between Bell Sound and South Cape. The projected work has a distinctly economic bias. Apart from a comparatively small government subvention it is financed by the coal companies interested.

Mention of economic interests inevitably brings one back to the political situation, now more interesting than ever. The war makes the status of *terra nullius* less tenable than before and appears to have rendered impossible any system of joint control (cf. Robert Lansing: A Unique International Problem, *Amer. Journ. Internatl. Law*, Vol. 11, 1917). German designs, revealed in the terms of the treaty of Brest Litovsk, have especially aroused apprehensions in Great Britain, one of the major claimants in the Spitzbergen archipelago. A statement of the British claims has recently been published by the Council of the Royal Geographical Society (British Interests in Spitsbergen, *Geogr. Journ.*, April, 1918, pp. 245-249). Press despatches from London under date of October 2 report the seizure several months ago by a British expedition of German coal and iron mines in Spitzbergen. The expedition was under the command of Sir Ernest Shackleton. A large number of miners, full mining equipment, and supplies sufficient for three years were taken, and work is now going on on a large scale. Captain Wild, who was with Shackleton in the Antarctic, is in charge of operations.

MATHEMATICAL GEOGRAPHY

Standard Time at Sea. In the matter of time-keeping a ship at sea has been "a law unto itself." The general practice has been to keep approximately local time, a proceeding in which there was no exactitude and much liability to confusion. Last year, through the activity of the Bureau des Longitudes, the French Admiralty established a

reform by extending to sea the time zones of the land, a reform subsequently taken up by the navies of Britain and Italy (P. Vincent: Planisphère des Fuseaux Horaires, map in 1:72,000,000, equatorial scale, Service Hydrographique, Ministère de la Marine, 1917; L'extension à la mer du régime des fuseaux horaires, *La Nature*, March 2, 1918, pp. 143-144). The results of a conference on this subject held by the British Admiralty are summarized by the *Geographical Journal* for February (Standard Time at Sea, pp. 97-100). The conference recommended the adoption of the boundaries of the time zones established by the French system, with which there was general agreement. Only in two respects were changes proposed, in the decision against usage of summer time on the high seas and in a matter of nomenclature. In the French system the time zones are numbered eastwards from 0 (Greenwich zone) to 23. To prevent ambiguity in reduction to Greenwich time the conference suggested the use of numerals with + signs for zones west of Greenwich (zero) to the date line and — signs for zones east of Greenwich to the date line.

There was also recommended a corollary reform of much practical convenience to navigators, the substitution of the civil for the astronomical day (A. C. D. Crommelin: Time at Sea and the Astronomical Day, *Nature*, April 25, 1918). In one respect the conference failed to arrive at a satisfactory conclusion—the matter of terminology; no adequate equivalent was found for the French *fuseau horaire;* the term "zone" can only be justified on the ground of accepted usage.

GEOGRAPHICAL NEWS

Personal

Mr. Charles C. Colby, for some time connected with the George Peabody College for Teachers at Nashville, Tenn., and later with the University of Chicago, has been promoted to an assistant professorship in geography at the latter institution.

Professor W. M. Davis read a paper on "The Peculiar Geographical Features of Northeastern France and Their Bearing on the War" at a general meeting of the American Philosophical Society at Philadelphia on April 18-20.

Mrs. Norman Hapgood (née Elizabeth K. Reynolds), whose article on "The Economic Resources of the Russian Empire" in the April, 1916, number of the *Review* will be recalled, is giving a course in Russian at Dartmouth College. The course is the first of its kind to be given at this institution; the geographical aspects of Russian life are given consideration.

Professor W. H. Hobbs of the University of Michigan read a paper on "The Relation of Deposits of Iron and Coal to the Great War" at a general meeting of the American Philosophical Society at Philadelphia on April 18-20.

Professor Vaughan MacCaughey, professor of botany at the College of Hawaii, Honolulu, has been lecturing on "The Islands of the Pacific and the World War" at educational centers during the past summer.

Dr. Griffith Taylor, physiographer of the Australian Commonwealth Bureau of Meteorology, whose work has frequently been mentioned in the *Review*, is giving a course of thirty lectures on Australian geography and meteorology at the University of Melbourne during the second and third terms, commencing June 21. Ten lectures are devoted to meteorology, four to climatology, six to land forms, and ten to economic geography. The group on climatology includes lectures on the control of settlement by temperature and rainfall, and the settlement of the Australian tropics; the group on economic geography takes up individually the resources of the seven divisions, including Tasmania, which constitute the Australian Commonwealth.

GEOGRAPHICAL PUBLICATIONS

(Reviews and Titles of Books, Papers, and Maps)

For key to classification see "Explanatory Note" in Vol. II, pp. 77-81

NORTH AMERICA

CANADA

Yukon, Northwest Territories, British Columbia

HAWORTH, P. L. **On the headwaters of Peace River: A narrative of a thousand-mile canoe trip to a little-known range of the Canadian Rockies.** xvii and 295 pp.; maps, ills. Charles Scribner's Sons, New York, 1917. $4.00. 9 x 6.

An account of a summer canoe trip for hunting on the headwaters of the Peace River, chiefly the Finlay and the Quadacha (White River), in British Columbia. Passing up the Finlay to its northern branch, the Quadacha, Haworth, with his trapper guide, Lavoie, followed the latter stream on foot and over the mountains, to avoid the canyon, to its forks. McConnell had previously visited this region (see F. K. Vreeland: Notes on the Sources of the Peace River, British Columbia, *Bull. Amer. Geogr. Soc.*, Vol. 46, 1914, pp. 1-24) and mapped a glacier at the source of the north fork of the Quadacha, which fork Haworth now names Warneford River, in honor of a Canadian, who single-handed brought down a Zeppelin at Ghent.

Before McConnell's visit, the explorers of the Hudson's Bay Company had undoubtedly overrun this entire section. A line of forts was established on both sides of the Rocky Mountains from the Columbia River to the mouth of the Mackenzie. Fort Frazer, Fort St. James, Fort McCloud, and others were located about the headwaters of the Peace River on or near the Finlay, and it is stated in the papers of the Hudson's Bay Company that this entire region was well known in the days of "McLoughlin's Transmontane Empire," otherwise called New Caledonia. But, it may be said, men like Frazer, Mackenzie, and McLoughlin were more interested in beaver pelts than in assigning names to the mountains and the ultimate divisions of the principal rivers.

Ten miles or more south of the forks of the Quadacha, according to the author's map, Haworth ascended "Observation Peak" and solved the problem of the white waters of the Quadacha. Though Warneford River rises in a glacier, it "showed clear water, while the east fork was even whiter than the Quadacha" at the junction with the Finlay. The east fork retains, therefore, the name of Quadacha. From the summit of Observation Peak there "unfolded nameless ridges, hundreds of nameless peaks, any of them taller than the highest in the Appalachian system." No elevations, not even of Observation Peak, are given by the author.

The finest mountain, with three peaks, lay to the northeast, distant forty or more miles (by the author's map), and to this mountain he gives the name of Lloyd George. It is the great glacier on the south of this mountain, breaking through from the unseen highlands that extend eastward, that occupies much of the author's space in the description of the country. The northern side of the glacier rests upon the southern slope of Mt. Lloyd George. He says, "I repeat, for emphasis, a great river of ice." Surely a glacier of the magnitude described by Haworth ought to be explored and named for its discoverer.

Haworth then returned to the Finlay and followed it to its confluence with the Fox. He next ascended the southern slope of McConnell's Prairie Mountain. To the northern portion of this ridge, which Haworth followed for a day and a half, he gave the name of Joffre Range. The mountains on the western side of the long canyon of the Finlay received the name of Kitchener Range.

The remainder of the narrative is a description of the country, interspersed with big game hunting. Haworth's account is useful when taken in connection with the records of the Hudson's Bay Company and their scouts of a century ago and with the report of McConnell.

An abbreviated version of this book has appeared in *Scribner's Mag.*, Vol. 61, 1917, No. 6, pp. 647-668; Vol. 62, 1917, No. 1, pp. 58-73. W. S. C. RUSSELL

BROWNLEE, J. H. **Geographical notes concerning known pastoral and agricultural areas in Yukon.** *Dawson Daily News*, Vol. 18, 1916, No. 16, Aug. 17, p. 8.

CAMSELL, CHARLES. **Guide to the geology of the Canadian National Parks on the Canadian Pacific Railway between Calgary and Revelstoke.** 70 pp.; maps, diagrs., ills. Dept. of the Interior, Ottawa, 1914. ["The material for this book is taken largely from the guide books written by D. B. Dowling, J. A. Allan, and R. A. Daly for the excursions of the Twelfth International Geological Congress" in Canada, 1913, which were reviewed in *Bull. Amer. Geogr. Soc.*, Vol. 47, 1915, p. 701.]

CHRISTIE, H. R. **The forests of central British Columbia.** *Forestry Quart.*, Vol. 13, 1915, No. 4, pp. 495-503. Washington, D. C.

HICKSON, J. W. A. **Experiences in the Canadian Rockies in 1915.** Ills. *Canadian Alpine Journ.*, Vol. 7, 1916, pp. 33-47.

HOLWAY, E. W. D. **First ascent of Mt. Edith Cavell and explorations in the Mt. Longstaff region.** Ills. *Canadian Alpine Journ.*, Vol. 7, 1916, pp. 63-66.

PALMER, HOWARD. **Early explorations in British Columbia for the Canadian Pacific Railway.** Map, ills. *Bull. Geogr. Soc. of Philadelphia*, Vol. 16, 1918, No. 3, pp. 75-91.

SMITH, J. G. **Pushing back the frontier.** Ills. Reprint from *Canadian Mag.*, Vol. 45, 1915, No. 5, pp. 379-384. [Recent developments in interior British Columbia north of the Canadian Pacific Railway.]

STONE, W. E. **Climbs and explorations in the Purcell Range in 1915.** Maps, ills., bibliogr. *Canadian Alpine Journ.*, Vol. 7, 1916, pp. 12-32.

STONE, W. E. **Climbs and explorations in the Purcell Range in 1915.** Maps, ills., bibliogr. *Appalachia*, Vol. 14, No. 1, 1916, pp. 19-37. [Different article from the preceding.]

STONE, W. E. **Climbs and explorations in the Purcell Range in 1916.** Map, ills. *Appalachia*, Vol. 14, No. 2, 1917, pp. 133-153.

UNSTEAD, J. F. **The economic resources of British Columbia.** Maps. *Geogr. Journ.*, Vol. 50, 1917, No. 2, pp. 125-145 (discussion, pp. 143-145).

WHEELER, A. O. **Some meteorological phenomena of the Canadian Rockies.** Ill. *Canadian Alpine Journ.*, Vol. 7, 1916, pp. 71-81.

—— ***Wheaton, Yukon Territory.*** 1:62,500. Map 59A. Geol. Survey of Canada, Ottawa, 1915.

—— ***Windermere, Kootenay District, British Columbia.*** 1:125,000. Map 165A. Publication No. 1582. Geol. Survey of Canada, Ottawa, 1918.

UNITED STATES

Western States

DARTON, N. H. **Story of the Grand Canyon of Arizona.** 81 pp.; maps, diagrs., ills. Fred Harvey, Kansas City, 1917. 8 x 5½.

A handsomely printed booklet of convenient size for the traveler to the Grand Canyon. It is full of useful geological and topographical details and closes with a list of place names and their derivation. In view of the author's descriptive power and the extraordinary nature of his subject the reviewer is disappointed in the literary style and general conception of the book. By this it is not meant that a florid style, or even one so enthusiastic as Dutton's, is desirable, but at least there should be a treatment which in dignity and beauty is commensurate with the noble forms and unrivaled colors of the canyon.

WHITTAKER, M. L. **Pathbreakers and pioneers of the Pueblo region, comprising a history of Pueblo from the earliest times.** 160 pp.; ills., index. Franklin Press Co., [Pueblo, Col.], 1917. 9½ x 6½.

A carefully written and well-published account of the rise of the region about the city of Pueblo, Colorado, from a barren expanse to a "magnificent district containing the metropolis of the southern Rocky Mountain region." As a history of a small section of the greater physical province, the book exemplifies, in general, the conditions of growth in hundreds of settlements in this part of the West, and, as a type presentation rather than for the historical information, it will be found to be valuable to the reader not directly interested in Pueblo. Brief sketches from the lives of the well-known trapper Carson and the explorer Frémont, who, though not directly concerned with Pueblo, were factors in the general westward movement, and stories of a host

of pioneers whose names have gone little beyond the areas of their conquests and labors, add a flavor of romance to the narrative. The hardships and privations of these pioneers, together with their struggles to wrest a living from this inhospitable land, are better measures of the physical environment of the Pueblo country than the actions and responses of the later inhabitants, whose business and social activities result, frequently, from the stimuli of distant and foreign surroundings.

ROBERT M. BROWN

—— [*Topographic map of the United States.*] Sheets: (1) ***Arena,*** (2) ***Arbuckle,*** (3) ***Atwater,*** (4) ***Birds Landing,*** (5) ***Gustine,*** (6) ***Logan Creek,*** (7) ***Planada,*** (8) ***Stevinson,*** (9) ***Williams, California,*** 1:31,680; (10) ***Del Norte, Colorado,*** 1:125,000; (11) ***Camel Mountain,*** (12) ***Mt. Riley,*** (13) ***Noria, New Mexico,*** 1:62,500; (14) ***Reserve, New Mexico,*** 1:125,000; (15) ***Hillsboro, Oregon-Washington,*** 1:62,500; (16) ***Wallula, Washington,*** 1:125,000; (17) ***Moorcroft, Wyoming,*** 1:125,000. U. S. Geol. Survey, Washington, D. C., 1917, 1918. [Mt. Riley and Noria, N. M., sheets surveyed in co-operation with the War Department.]

EUROPE

GENERAL

RECLUS, ONÉSIME, edit. **Grande Géographie Bong illustrée: Les pays et les peuples: Vol. 1 [Europe].** vii and 371 pp.; maps, diagrs., ills. J. G. KERGOMARD: **Royaume-Uni de Grande Bretagne et d'Irlande,** pp. 3-74; E. A. MARTEL: **France,** pp. 77-196; A. CABATON: **Belgique,** pp. 199-222; A. CABATON: **Hollande,** pp. 225-246; A. RAINAUD: **Italie,** pp. 249-306; ÉMILE BELLOC: **Espagne et Portugal,** pp. 309-364. **Vol. 2 [Europe].** 366 pp.; maps, diagrs., ills. GUSTAVE REGELSPERGER: **Allemagne,** pp. 3-100; GUSTAVE REGELSPERGER: **Autriche-Hongrie,** pp. 103-174; GUSTAVE REGELSPERGER: **Suisse,** pp. 177-204; PAUL LEMOSOF: **Russie d'Europe,** pp. 207-290; ANTOINE CABATON: **Péninsule des Balkans (Grèce, Monténégro, Serbie, Roumanie, Bulgarie, Turquie),** pp. 293-359. Bong & Cie., Paris, 1911 and 1912. 15 x 12.

There is a public in France that buys great album-like pictorial works of the most luxurious sort, and when French publishers undertake to fill that need they make sumptuous works indeed. The covers of these books are very elaborate, as if the books were designed to adorn center tables; indeed they are so big and so heavy that they could hardly be used in any other way.

Only a member of this public could adequately review the Géographie Bong, a most beautiful, up-to-date work of the sort. An evening spent with it has not sufficed to read its 700 pages nor even to examine carefully all of its excellent pictures of famous towns, buildings, and landscapes, but it has left a distinct impression of a beautiful book that preserves word and picture records of the noted and salient features of Europe. In types, generalizations, and inner meanings it has little interest. A feature is made of views from balloons, the least successful from an altitude of 3,000 meters. From 800 meters and lower there are a number of excellent views of Berlin, Paris, Düsseldorf, and Karlsruhe. There is an admirable balloon side view of the Eiffel Tower and one of Mt. Pilatus. A number of striking views are colored. The text does not limit itself to mere description but adds charming touches of history, of the sort that clings to much of the old-world landscape. The history is quite disconnected; the geography is systematic in a superficial way, in that it treats of the prominent features of each country, including many excellent diagrams of geology, rainfall, population density, and economic distributions. The style is popular but entirely serious and dignified. Withal the work is a good example of pictorial geography.

One other volume in the series has been reviewed previously (Vol. 4, Africa, *Geogr. Rev.*, Vol. 4, 1917, p. 327).

MARK JEFFERSON

AFRICA

GENERAL

DU PLESSIS, J. **Thrice through the Dark Continent: A record of journeyings across Africa during the years 1913-16.** viii and 350 pp.; map, ills. Longmans, Green & Co., London and New York. $4.50. 9 x 6.

The author first crossed the continent from Kumasi on the Gold Coast via Lagos into the Sudan and by the Shari, Ubangi, and Welle rivers to Uganda and British East Africa. Return was made through the volcanic country north of Lake Kivu, the most difficult stretch in the itinerary, and down the Congo. In the third trip the Congo was crossed farther south, use being made of the Kasai and Lualaba Rivers,

the route then running through Northern Rhodesia and Nyasaland. The entire journey of 17,000 miles consumed little more than two years, a tribute to the development of communications in the Dark Continent. For the most part it followed recognized highways and contributes nothing new, but the author saw much that was interesting and describes it well in a pleasant, good-humored style. He has an eye, too, for the broad features of the landscape. Thus he notes the physical affinities of Katanga with the South African plateaus. "At Bukama I seemed to have finally left the Congo proper behind and to have arrived in a country which in outward aspect approximates as nearly as possible to South African conditions." Travel in the Sudan receives the most detailed description. A typical account is that of the tribes dwelling about the Tuburi Lakes, part of the divide between the Benue and Shari systems. These interesting peoples, wealthy and industrious as natives go, occupy a fertile, well-watered country, one of the most densely peopled parts of Africa, "I counted not less than a hundred villages within a radius of three miles, each of which must have held at least a hundred inhabitants." This district, still pagan, calls forth an appeal for Christian missions before Mohammedanism gets a footing. Wherever Islam has entered, the progress of Christianity is retarded, and Islam is strong in the Sudan.

GIBBONS, H. A. **The new map of Africa (1900-1916): A history of European colonial expansion and colonial diplomacy.** xiv and 503 pp.; maps, index. Century Co., New York, 1916. $2.00. 8½ x 5½.

The book is chiefly political, only incidentally geographical; but none the less it contains some geographical fact and suggestion and will well repay perusal by any student of geography. It does not mention the most conspicuous geographical service that the Germans rendered in their former colonies—the detailed topographical maps that cover all of Togo and large areas in the other possessions. The author thinks that Germany excelled the other colonizing powers in road building for co-operation with railroads, in comfortable accommodations for travelers in the interior, in scientific forestry, and in supervision of the public health. He characterizes the treatment that the Germans inflicted upon their native subjects as atrocious but doubts the expediency of excluding Germany from participation in African development after the war.

The British and Boers are a unit in declaring that they will never consent to the admission of more East Indians to South Africa. They say that "the unrestricted right of entry to these Asiatics would lower the whole standard of living for the white man and make his existence in the country impossible." The British Viceroy in India, who for nine years has protested against the attitude of South Africa, has given up the struggle, and all that is now asked for is that more liberal treatment be given to the Indians already in the country. CYRUS C. ADAMS

BLESSICH, ALDO. **Geografia storica delle dipendenze continentali: Il disegno dell' Africa Romana.** *L'Africa Italiana*, Vol. 35, 1916, No. 5-6, pp. 81-101.

ENGLER, A. **Die Pflanzenwelt Afrikas, insbesondere seiner tropischen Gebiete: Grundzüge der Pflanzenverbreitung in Afrika, und die Charakterpflanzen Afrikas. Vol. 3, No. 1 (Charakterpflanzen Afrikas, insbesondere des tropischen: Die Familien der afrikanischen Pflanzenwelt und ihre Bedeutung in derselben), Part 2: Die dikotyledonen Angiospermen Casuarinaceae bis Dichapetalaceae.** vi and 869 pp.; diagrs., ills., index. (Series: Die Vegetation der Erde, Vol. 9, Part 3.) Wilhelm Engelmann, Leipzig, 1915. £1, 14s. 6d. 10 x 7. [Additional volume in the fundamental work on the plant world of Africa by Professor Engler. The whole work is projected to comprise five volumes. Two, besides the present, have already appeared: Volume 1 (in two parts), a general survey, which was reviewed in *Bull. Amer. Geogr. Soc.*, Vol. 44, 1912, pp. 920-921; and Volume 2, dealing with the individual families, a topic continued in the present volume and to include Volume 4. Volume 5, the final volume, will again be of special interest to geographers as it will discuss the vegetational provinces.]

JOHNSTON, H. H. **The importance of Africa.** *Journ. African Soc.*, No. 67, Vol. 17, 1918, April, pp. 177-198.

LEWIN, EVANS. **Railways in Africa.** Maps. *United Empire*, Vol. 8, N. S., 1917, No. 1, pp. 23-30; No. 2, pp. 94-99; No. 3, pp. 172-178.

LIÈVRE, D. **Trois stations hivernales (Le Caire, Alger, Tanger).** Ills. *Bull. Soc. de Géogr. Commerc. du Havre*, Vol. 30, 1913, No. 2, pp. 237-248; No. 3-4, pp. 312-336; Vol. 31, 1914, No. 1, pp. 21-32; Vols. 31-32-33, 1914-17, No. 1, pp. 55-72.

ROOSEVELT, THEODORE. **My life as a naturalist, with a presentation of various first-hand data on the life histories and habits of the big game animals of Africa.** Ills. *Amer. Museum Journ.*, Vol. 18, 1918, No. 5, pp. 321-350.

THIERRY, RENÉ. **L'Afrique de demain et le pangermanisme colonial.** *L'Afrique Française*, Vol. 27, 1917, No. 5-6, pp. 167-175; No. 7-8, pp. 253-263.

TORINO Y ROLDÁN, JOSÉ. **Los ferrocarriles en África.** Bibliogr. *Rev. de Geogr. Colon. y Mercantil*, Vol. 14, 1917, No. 10-11, pp. 372-424. Real Soc. Geogr., Madrid.

AUSTRALASIA AND OCEANIA

AUSTRALIA, NEW ZEALAND

COTTON, C. A. **Block mountains in New Zealand.** Maps, diagrs., ills., bibliogr. *Amer. Journ. of Sci.*, No. 262, Vol. 44, 1917, pp. 249-293.

Formerly the mountains of New Zealand, that is to say, the Southern Alps and other chains formed of the older rocks, were regarded as one-cycle fold mountains. In recent years the opinion has been gaining ground that the original fold mountains were more or less completely destroyed by erosion prior to an uplift which initiated the sculpture of the present ranges. The view is now put forward that not only were the fold mountains destroyed by erosion but also that their site was largely covered by younger rocks, and that the later uplifts, to which the present relief is due, were differential. The features to which they gave rise are still, in some parts of New Zealand, well-preserved block mountains, and practically everywhere the tectonic nature of the relief is still recognizable. New Zealand may, in fact, be described as a concourse of earth blocks, the highest of which lie in the northeast and southwest axis of the land mass (C. A. Cotton: The Structure and Later Geological History of New Zealand, *Geol. Mag.*, Vol. 3, 1916, pp. 243-249 and 314-320; reviewed in the *Geogr. Rev.*, Vol. 3, 1917, pp. 83-84).

It is perhaps in central Otago (the southern province of South Island) that the structure and the history of the earth movements are best displayed by the topography. This region is treated in detail in the article "Block Mountains in New Zealand," of which the author sends the following summary:

"The landscape of this part of Otago is a mosaic of blocks. A group of the lower-lying blocks determines a chain of basins, which have been known in the past as old lake basins, though it is not clear that they have ever been occupied by lakes. This is the chain of lowlands followed by the Otago Central Railway. The depressions occupied by large lakes farther west—Wakatipu and Te Anau—were perhaps initially of the same nature, but they have been profoundly modified by glacial erosion. In central Otago the covering strata are largely of terrestrial origin and have been preserved over considerable areas on the low-lying blocks in the depressions, though only a few remnants survive on the higher blocks. The configuration of the higher blocks shows very clearly the nature of the deformation, as extensive areas of the fossil plain that formed the floor on which the cover lay are preserved. The manner in which the fossil plain is warped and dislocated is clearly seen. The majority of the central Otago blocks are elongated, trending northeast and southwest, and are more or less tilted towards the northwest. These blocks slope down gently to their northeastern ends, to merge with the chain of depressions previously referred to, which occupy a complex fault-angle depression at the base of the fault scarps bounding a complex of high blocks forming the northern highland of Otago."

In reference to a principle involved in the treatment of the article thus briefly outlined, attention may be called to recent comment by Professor W. M. Davis. In *Science* for July 26, 1918, pp. 81-84, Professor Davis answers the previous criticism of J. L. Rich that the author entirely omits mention of geological dates (*Science*, Jan. 11, 1918, pp. 43-44). Professor Davis, who has repeatedly protested against the bondage of geography to geology in questions of nomenclature and habits of thought, points out that Cotton's treatment in the above article is systematically geographical in quality. He commends it as an example of freedom from this bondage, as "an admirable experiment in the analytic, systematic, and regional treatment of a geographical problem."

HERBERTSON, A. J., AND O. J. R. HOWARTH, edits. **The Oxford Survey of the British Empire: Australasia, including Australia, New Zealand, the Western Pacific, and the British sector in Antarctica.** xii and 584 pp.; maps, diagrs., ills., index. Clarendon Press, Oxford (Oxford Univ. Press, Amer. Branch, New York), 1914. 14s. 9 x 6.

This volume is one of a series of six covering the respective parts of the British Empire, of which two have already been noticed (America, *Bull. Amer. Geogr. Soc.*, Vol. 47, 1915, pp. 971-972; Africa, *Geogr. Rev.*, Vol. 1, 1916, p. 70). At the end of each chapter is a rather complete bibliography of the best sources. A gazetteer of

towns, covering 8 pages, and 23 pages of statistics conclude the work. Excellent colored bathy-orographical maps of Australasia, of southeastern Australia, and of New Zealand, many good black-and-white maps and diagrams and interesting half-tone photographs of Australasian scenery help clinch the arguments and inject much life into the presentation.

The several chapters are written by specialists. In this respect the book borders somewhat upon the compendium style. At times the writers seem a bit overenthusiastic and cause one who reads critically to feel that possibly a few points are occasionally strained in favor of Australasia. However, at no time does this reach serious proportions. The book is a study of modern Australasia rather than an historical treatise. It aims to develop the economic phases. So many interesting statements following in quick succession are worthy of review that one hardly knows which to eliminate.

"In Western Australia, wheat farming is possible with an annual rainfall of 12 to 14 inches" without irrigation. This is accomplished where the rainfall is evenly distributed throughout the year. No reference is made to the rate of evaporation. One wonders whether some parts of the United States might not profit from the Australians.

Among the many striking features that will always mark Australia apart from the rest of the world is the fact that "as a whole the extremes of temperature annually, seasonally, and daily are less than those experienced in any of the other continents." Drought is still recognized as perhaps the biggest single handicap to the continent, but hopes are entertained that with the modern developments in agriculture it can be ameliorated, if not perhaps, in some sections, entirely overcome.

"No accurate contour maps have yet been made of any portion of Australia." The geology is likewise, with a few exceptions, still only known in a general way. But much progress is being made. The geological cross-sections, for example, reveal a very considerable knowledge concerning the amount of faulting along the east coast and throughout the Dividing Range.

In the chapter on "Economic Conditions and Industries" the speculative but none the less practical question is raised as to the possibilities, in view of the work that has been accomplished in the evolution of the unexcelled merino sheep, of evolving a "new and distinctive type of Anglo-Saxon people." This of course does not imply a depreciation of the present Anglo-Saxon.

The discovery of gold in the various parts of Australia, the introduction of cold-storage shipping, and the revelation of the agricultural possibilities of the region may perhaps be mentioned as the prime stimulants to progress up to date. All of these have also had their effect upon the distribution of the population. But the outstanding controlling influence is rainfall. "The population is greatest wherever the rainfall is most abundant."

The states control the railroad lines within their territory. The gages are unfortunately of three different sizes. Some steps are being taken to remedy this condition. The telegraph, telephone, and cable are also government-owned. The island character of the country gives it a geographical unity which the people believe will eventually weld them into a homogeneous whole such as no other country might hope to attain. The isolation of the continent has inclined the residents toward the spirit expressed in the words "Australia for the Australians and more Australians for Australia."

The progress of New Zealand, the standards in government that have held the attention of the world, the natural resources, the agricultural development, and the establishment of foreign intercourse are all attractively set forth. Papua as a territory of the Commonwealth of Australia, and a consistently up-to-date presentation of recent exploration in the British sector of Antarctica round out this rather imposing and well-written symposium on Australasia. EUGENE VAN CLEEF

SCHLICH, SIR WILLIAM. **Forestry in the Dominion of New Zealand.** *Quart. Journ. of Forestry*, Vol. 12, 1918, No. 1, pp. 1-28.

The three islands considered, North, South, and Stewart, comprise 102,912 square miles, with a surface greatly diversified. High mountain ranges stretch from East Cape in the northeast to West Cape in the southwest, and are surrounded by downs, an elevated sea floor eroded to a hilly surface, valuable for agriculture and pastureland. The lower beds are sandy or gravelly—poor soils. In the north clay lands, from which the ancient deposits of kauri gum are dug, are also poor. The plains, with their alluvial soil, are not large but are the important districts for agriculture. The coasts with their wide fringes of shallow sand or gravel beaches afford comparatively few harbors and little shelter for shipping.

The temperature is equitable, the rainfall variable but sufficient for agricultural

purposes, ranging from 200 inches on the west coast of South Island to less than 30 inches on the east coast. The natural vegetation is distinctly semi-tropical, and the wild forest is almost impenetrable on account of the large number of lianas. Three-fourths of the indigenous plants are confined exclusively to New Zealand, and the whole vegetation is strikingly different from that of Australia.

The forests are partly pure but mostly mixed and of very uneven stocking. There remain about 4,000,000 acres of forests fit for milling purposes. The total quantity of commercial timber was estimated in 1909 to be 33,061,000,000 superficial feet, composed of the following (arranged in order of their quality): kauri (*Agathis*, or *Dammara, australis*), 1.5 per cent; totara (*Podocarpus totara*), 1.7 per cent; matai (*Podocarpus spicatus*), 10.4 per cent; rimu (*Dacrydium cupressinum*), 46.5 per cent; kahikatea (*Podocarpus dacrydioides*), 7.8 per cent; beeches (three species of *Nothofagus*), 13.3 per cent; miscellaneous, 18.8 per cent.

The existing milling timber will probably be exhausted within twenty years. Up to 1918 about 25,000 acres had been planted by the state and 44,000 acres by private owners. Much more extensive planting of fast-growing species is urgently recommended.

SAMUEL J. RECORD

ANDREW, E. C. **Shoreline studies at Botany Bay.** Diagrs., ills. *Journ. and Proc. Royal Soc. of New South Wales for 1916*, Vol. 50, Part I, pp. 165-176. Sydney.

COCKAYNE, A. H. **Some economic considerations concerning montane tussock grassland.** *Trans. and Proc. New Zealand Inst. for 1915*, Vol. 48, pp. 154-165. Wellington, 1916. [Abstracted under the title of "A Unique Grassland in New Zealand" in the *Review*, Vol. 3, 1917, p. 488.]

COCKAYNE, L., AND C. E. FOWERAKER. **Notes from the Canterbury College Mountain Biological Station: The principal plant associations in the immediate vicinity of the station.** Ills. *Trans. and Proc. New Zealand Inst. for 1915*, Vol. 48, pp. 166-186. Wellington, 1916.

COTTON, C. A. **Block mountains and a "fossil" denudation plain in northern Nelson.** Maps, diagrs. *Trans. and Proc. New Zealand Inst. for 1915*, Vol. 48, pp. 59-75. Wellington, 1916. [The author believes that the present-day topography of New Zealand is due to "a late disorderly uplift." "New Zealand may be described as a concourse of earth-blocks of varying size and shape, in places compressed, the highest blocks lying in the north-east and south-west axis of the land-mass, so that the whole structure may be termed a geanticline." He uses this hypothesis in the interpretation of the physiography of northern Nelson, on the northwest corner of South Island.]

DOWNES, T. W. **New light on the period of the extinction of the moa (according to Maori record).** *Trans. and Proc. New Zealand Inst. for 1915*, Vol. 48, pp. 426-434. Wellington, 1916. [The author believes that the moa of North Island was exterminated by the Maori not long after their arrival in New Zealand, that is not less than four or five hundred years ago, and that its extinction in South Island took place a hundred years later.]

MOORE, E. S. **The active volcanoes of New Zealand.** Maps, ills. *Journ. of Geol.*, Vol. 25, 1917, No. 8, pp. 693-714.

—— **New Zealand vegetation.** *Journ. of Ecology*, Vol. 4, 1916, No. 1, pp. 43-45. [A review of D. L. Poppelwell's "Notes on the Plant Covering of the Garvie Mountains, with a List of Species," *Trans. and Proc. New Zealand Inst.*, Vol. 47, 1914, p. 120; W. R. B. Oliver's "The Vegetation of White Island, New Zealand," *Journ. Linn. Soc. London*, Vol. 43, 1915, pp. 41-47; and E. J. Pegg's "An Ecological Study of Some New Zealand Sand-Dune Plants," *Trans. and Proc. New Zealand Inst.*, Vol. 46, 1913, pp. 150-177.]

OLIVER, W. R. B. **The vegetation and flora of Lord Howe Island.** Diagrs., ills., bibliogr. *Trans. and Proc. New Zealand Inst. for 1916*, Vol. 49, pp. 94-161. Wellington, 1917. ["Situated in a tract of ocean which bounds three biological regions of the globe, and on a submarine ridge connecting two of these, Lord Howe Island is at once of intense interest to the biologist. This island, remarkable not only for its biological productions but also on account of its geological structure, lies about 430 km. eastward of the Australian Continent, in S. lat. 31° 32'."]

SINNOTT, E. W. **The "age and area" hypothesis of Willis, recently discussed and endorsed by Professor De Vries** ("The Distribution of Endemic Species in New Zealand," *Science*, Vol. 45, 1917, June 22, pp. 641-642). *Science*, Vol. 46, 1917, Nov. 9, pp. 457-459.

SPEIGHT, R. **An ancient buried forest near Riccarton: Its bearing on the mode of formation of the Canterbury Plains.** Ills., bibliogr. From *Trans. and Proc. New Zealand Inst. for 1916*, Vol. 49, pp. 361-364. Wellington, 1917.

SPEIGHT, R. **The orientation of the river-valleys of Canterbury.** Map. *Trans. and Proc. New Zealand Inst. for 1915*, Vol. 48, pp. 137-144. Wellington, 1916. [Discusses the tectonic theory first propounded by Dobson in his report for the year 1865 on "The Possibility of Constructing a Road through the Otira Gorge."]

SPEIGHT, R. **The physiography of the Cass district.** Map, bibliogr. *Trans. and Proc. New Zealand Inst. for 1915*, Vol. 48, pp. 145-153. Wellington, 1916. [Glaciation has been chiefly responsible for the details of topographic form.]

THOMSON, J. A. **Diastrophic and other considerations in classification and correlation, and the existence of minor diastrophic districts in the Notocene.** Bibliogr. *Trans. and Proc. New Zealand Inst. for 1916*, Vol. 49, pp. 397-413. Wellington, 1917. [The term Notocene (*νότος*, south; *καινός*, new) is proposed as an age name for the younger rock series of New Zealand.]

WILD, L. J. **On the proposal for a soil survey of New Zealand.** Map, diagr. *Trans. and Proc. New Zealand Inst. for 1916*, Vol. 49, pp. 476-490. Wellington, 1917. [The author advocates the adoption of a combined system of soil classification similar to that employed in the United States surveys instead of the geologico-petrographical classification used in ngland. The combined system groups soils first according to mechanical composition, then subdivides according to chemical composition or other features. It is further suggested that the country should be first divided into soil districts, for which climate should be the criterion. Geological formations yielding soils with unique agricultural properties may give rise to subdistricts. Within the districts and subdistricts soil formation will be classified by the method referred to above. A tentative division of South Island into soil districts is given in illustration.]

WORLD AS A WHOLE AND LARGER PARTS

CLEMENZ, BRUNO. **Kriegsgeographie: Erdkunde und Weltkrieg in ihren Beziehungen erläutert und dargestellt, nebst Schilderung der Kriegsschauplätze.** 278 pp.; maps. (Series: In den Gluten des Weltbrandes, herausgegeben von Felix Heuler, Vol. 4.) Curt Kabitzsch, Würzburg, 1915. M 2. 9 x 6.

This book, Volume 4 of the "In the Glow of the Universal Conflagration" series, is entirely popular in treatment and frankly German in sentiment. The geographical relations of the present war are explained, and descriptive sketches of the various war theaters are given. Its aim is to offer abundant material for private study. The introductory section of 48 pages contains little of geographic interest. Then follow three papers on the Sea and the War, the Sea As a Theater of War, and World Canals and World War. One half of the last is devoted to the strategic relations of the Panama Canal.

The bulk of the book is devoted to a description of the war geography of the belligerent powers of Europe, including Greece and Portugal. The treatment is by political divisions rather than geographical regions. Turkey is found among the principal nations of Asia, and a separate section is given to "Unser Tsingtau." Only Egypt and Morocco of Africa are included, and colonial possessions are hardly mentioned. The American section includes only the "United States of North America" and the Falkland Islands. Australia receives a separate chapter as the fifth continent in the war. The Japanese situation with reference to the United States receives considerable attention. The last three chapters discuss in closer detail certain districts intimately connected with recent military operations. Under "From the Background of the Conflict," we have the Vosges, the Argonne, the Carpathians, the Dardanelles, etc. Under "Scenes from the World War," we have Antwerp, the Masurian Lakes, Przemysl, and Ukraine. The concluding chapter takes up the geographical bigness, the puzzle, and the lessons of the war. Many excellent relief maps and several charts illustrate the various regions.

JAMES GORDON STEESE

CORBETT, J. S. **England in the Mediterranean: A study of the rise and influence of British power within the straits, 1603-1713.** 2nd edit. Vol. 1: viii and 297 pp., map; Vol. 2: pp. 298-603, map, ill., index. Longmans, Green, and Co., London, 1917. $5.00 (2 vols.). 8 x 5½.

The consolidation of British naval power in the Mediterranean was the result of protracted endeavor. The long history of preparation and of diplomatic and naval activity is presented in this second edition of Mr. Corbett's book. A critical examination of his

work cannot fail to show the great part played by the daring and initiative of English captains and merchants. Far from home bases and having to contend not only with the hostility of the French, but with that of Dutchmen and Spaniards as well, these men, whose names are in many instances unknown, met adverse conditions with a determination to win. The whole struggle which ended in the capture of Gibraltar was economic. Its aim was to divert the trade of the East to British ports without the agency of foreign middlemen.

To the British exporter and importer the Mediterranean in the seventeenth century was the central section of one of the main roads of foreign traffic. A hundred years earlier the trade of the Levant, sorely hampered by the growth of Turkish power in Europe, had been deflected towards southern channels. The seaports of Asia Minor and of Syria nevertheless were the markets for a large part of western Asia's commerce with Europe. With the decline of Turkish naval power, it became easier for European traders to force an entrance into Turkish ports in spite of reluctant harbor masters. But as to the coincidence of British naval supremacy in the Mediterranean and the decline of the Turkish naval power the author makes no mention.

Neither does he mention the privileged status of European merchants in Turkey as soon as the régime of the Capitulations was inaugurated by French effort. A new era of prosperity was begun in the Levant by this diplomatic victory of the French, for it came at a time when the discovery of the sea route to India was leading to the abandonment of the older Levantine lanes of traffic. The British, on the whole, derived greater commercial benefit from the Capitulations than did the French.

The wealth of detail which makes up Mr. Corbett's historical study emphasizes the importance of the Mediterranean route. The great inland sea is the maritime highway which connects three old continents. And all the struggles between statesmen and soldiers recorded in these pages merely serve to show how much the mastery of this waterway was coveted.

SAFFORD, W. E. **Food plants and textiles of ancient America.** Ills. *Proc. 2nd Pan Amer. Sci. Congr., Dec. 27, 1915, to Jan. 8, 1916,* Vol. 1, Section 1: Anthropology, pp. 146-159. Washington, D. C., 1917.

SINGER, D. J. **Big game fields of America, North and South.** 368 pp.; ills. Hodder & Stoughton, London; George H. Doran Co., New York, 1916. $2.25. 9 x 6.

TÄUBER, C. **Auf fremden Bergpfaden.** 513 pp.; ills. Art. Institut Orell Füssli, Zurich, 1916. 8 x 5½. [In southern Europe and northern Africa.]

WOLFF, H. **Die Schwerkraft auf dem Mittelländischen Meere und die Hypothese von Pratt.** *Beiträge zur Geophysik: Zeitschrift für Physikalische Erdkunde,* Vol. 14, 1916, No. 3, pp. 206-214.

WOODWARD, R. S. **Desirability and practicability of extending a precise network of triangulation over the South, Central, and North American areas. The desirability and practicability of extending a gravimetric survey over the same areas.** *Proc. 2nd Pan Amer. Sci. Congr., Dec. 27, 1915, to Jan. 8, 1916,* Vol. 2, Section 2: Astronomy, Meteorology, and Seismology, pp. 278-280 (discussion, p. 280). Washington, D. C., 1917.

—— ***Mediterranean Basin, Monthly Meteorological Charts of the.*** 12 sheets. 1:10,000,000. On reverse side of all except January sheet: Greece and Aegean Sea, 1:5,000,000; Currents. Fog and Mist. 1:20,000,000, for the preceding month. *M[eteorol.] O[ffice] [Publ. No.] 224.* 2nd edit., Meteorological Office, London. 1916, 1917. [Data shown represent mean values for each month based on longest series of observations available.]

PHILIP, GEORGE. edit. ***Philips' Record Atlas: A series of 128 pages of coloured political maps of the world, with complete index.*** George Philip & Son, Ltd., London, 1917. 10 x 7. 6s. net. [Usual style of atlas catering to locational geography—mainly maps with political coloring and relief in black hachuring. The only distinctive maps are an isochronic map of the British Isles and the adjacent parts of the Continent, with London as the center and nine accessibility zones, and a physical map of the Alps.]